ONTARIO'S ENERGY CHOICES CONFERENCE

April 3-4, 1989
Toronto, Ontario

CONFERENCE PROCEEDINGS

Sponsored by

Ontario Ministry of Energy

Canadian Energy Research Institute

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Sheraton Centre, Toronto, Ontario

TABLE OF CONTENTS

SECTION 1 — ***Keynote Addresses***

A FUTURIST VIEW OF SOCIETY AND ITS ENERGY NEEDS

***John Kettle**, President*
John Kettle Incorporated
Toronto, Ontario

PUBLIC ATTITUDES TO ONTARIO'S ENERGY CHOICES AND PROTECTION OF THE ENVIRONMENT

***Senator Michael Kirby**, Vice President*
Goldfarb Consultants,
Toronto, Ontario

ENERGY CHOICES FOR ONTARIO

***Robert C. Wong**, Minister of Energy*
Province of Ontario

** *The presentation on **World Energy Supply/Demand Outlook** given by **Dr. Daniel Yergin**, President, Cambridge Energy Research Associates, Cambridge, Massachusetts is not available for reproduction.*

89-04909/

Panel Presentations

SECTION 2 — *THE NEW NORTH AMERICAN MARKETPLACE -- IMPLICATIONS FOR ONTARIO*

A. Denny Ellerman*, Vice President*
Charles River Associates Incorporated
Washington, D.C.

Henry Lee*, Executive Director*
Energy and Environmental Policy Centre
Harvard University
Cambridge, Massachusetts

Jean-Guy Fredette*, Vice Chairman*
National Energy Board
Ottawa, Ontario

SECTION 3 — *ENERGY AND THE ENVIRONMENT*

Gerry Finn*, Director of Government Relations*
Polysar Limited
Sarnia, Ontario

Dr. Kenneth Hare*, Professor Emeritus of Geography*
University of Toronto
Toronto, Ontario

Colin Isaacs*, Executive Director*
Pollution Probe Foundation
Toronto, Ontario

SECTION 4 — *ENERGY NEEDS FOR THE FUTURE*

Carl Beigie*, Chief Economist*
McLean McCarthy
Toronto, Ontario

Dr. E. Philip Cockshutt*, Executive Director*
Engineering Program
National Research Council
Ottawa, Ontario

Dr. David K. Foot*, Professor of Economics*
University of Toronto
Toronto, Ontario

James A. Hughes*, Manager*
Energy and Industry Outlook
Imperial Oil Limited
Toronto, Ontario

SECTION 5 *NATURAL GAS IMPACT ON ENERGY MARKETS*

***Stephen Bellringer**, President*
Union Gas Limited
Chatham, Ontario

***Ted Bjerkelund**, Executive Director*
Industrial Gas Users Association
Ottawa, Ontario

***Dennis Cornelson**, Vice President, Marketing*
Alberta Energy Company Ltd.
Calgary, Alberta

***Art A. Douloff**, Vice President, Transportation*
TransCanada PipeLines Limited
Toronto, Ontario

SECTION 6 *CONSERVATION AND EFFICIENCY*

***Donald E. Buchan**, Director*
R-2000 Project
Canadian Home Builders' Association
Ottawa, Ontario

***Joan Huzar**, Vice President, Issues & Policy*
Consumers' Association of Canada (Ontario)
Toronto, Ontario

***Gerry H. Johnston**, Assistant Deputy Minister*
Ontario Ministry of Transportation
Downsview, Ontario

***Claude Kerr**, Superintendent of Central Utilities*
Ontario Division
INCO Limited
Copper Cliff, Ontario

***Ian Jarvis**, Vice President*
Rose Technology Group Ltd.
Willowdale, Ontario

***Dane MacCarthy**, Vice President, Energy Management*
Ontario Hydro
Toronto, Ontario

***Peter Torbet**, Chairman*
Canadian Industry Program for Energy Conservation
Task Force Council
Ottawa, Ontario

SECTION 7

ALTERNATIVE ENERGY CHOICES

Ron M. Bright, Director
Environmental Control and Vehicle Safety
Ford Motor Company of Canada Limited
Oakville, Ontario

Donald R. Huffman, Partner and Director
Ensyn Engineering Associates Inc.
Gloucester, Ontario

Doug Lorriman, President
Ballinafad Research
Ballinafad, Ontario

Jeff Passmore, President
Passmore Associates International
Ottawa, Ontario

SECTION 8

THE ELECTRICITY OPTIONS

Marc Eliesen, National Director of Government Services
Stevenson Kellogg Ernst & Whinney
Ottawa, Ontario

Robert C. Franklin, Chairman and President
Ontario Hydro
Toronto, Ontario

Brian Kelly, President
Marbek Resources Consultants Ltd.
Ottawa, Ontario

Don S. Lawson, President
CANDU Operations
Atomic Energy of Canada Limited
Mississauga, Ontario

SECTION 9

CONFERENCE SUMMATION

Mr. Tom Kierans, President and Director
ScotiaMcLeod Inc.
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A FUTURIST VIEW OF SOCIETY AND ITS ENERGY NEEDS*

Presented by

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ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April3-4, 1989

*** This paper was transcribed directly, with very few editorial changes, from the tape of Mr. Kettle's remarks.**

I am honoured to be here to have a chance to speak to people whose interest is in energy, one of the most important subjects we could talk about.

I started thinking in a formal way about energy and the future of energy in the 1960 s, so you can tell that we've gone through some kind of ups and downs since then. In the 1960s and 70s we used to produce glowing forecasts of unlimited energy available for us. That was, of course, before the OPEC oil crisis of 1973. But it seems interesting just to remind younger members of the audience today of the sort of thing that was being said. In 1965, the President of Boston Edison, Charles Avilla, said, "The world stands unaware on the edge of an era when energy resources will be boundless. For the customer, this heralds a time when the amount of electricity he uses will make no difference in his bill. He will pay only a flat rate for the peak demand he makes in any one year." In 1970 the Canadian Minister of Energy, Joe Green, said, "At current rates of production, Canadian reserves represent 923 years' supply of oil and 392 years for gas." And everybody said, "Well that sounds like enough." And a bit later that year, Jean Luc Pepin, who was Minister of Industry, Trade and Commerce, said it would be crazy to sit on these reserves. In maybe 25 or 50 years we'll be heating ourselves from the rays of the sun, and then we'll kick ourselves for not capitalizing what we had when oil and gas was a commodity. And he was urging the sale of these commodities.

I remember we proposed all kinds of ingenious and interesting uses for all that surplus energy. One of my favorites was heating the St. Lawrence during the winter so that you could have year-round navigation. It was a serious proposal. Widespread desalinization of oceans in order to produce clean water in places like Arabia. A silent city where there was so much energy that you could run all the motors at half throttle. You could extract minerals from ore which had just mere parts per million because it didn't matter how much you had to bring down. You could take ice and snow out of Arctic habitats. You could do open air heating and cooling in cities so that you did not have to put domes over them. We were very ingenious in thinking up ways for doing all of this. And then we went to something else. We went from not knowing what to do with all that energy, to not knowing where the next fill up was coming. And that's the point at which other people are beginning to click in. Now we seem to have moved to an in-between position. On Mondays, Wednesdays and Fridays we worry a lot and go to conferences about energy and things like that. And on Tuesdays, Thursdays and Saturdays we think everything is fine and we go out and buy big cars or we go shopping for big cars.

I think that somewhere the future is not simply saying how do you balance off these two things, but how can you see what is really going on? And since I'm a futurist, I'd like to make some remarks that may be ap~~p~~ropos of what's coming. The most interesting and obvious thing to me about energy is that in the time that I've been thinking about it, two noble causes, something rather surprising, have come together. One is saving the environment, and the other is saving energy. They were not together. If you remember, Energy Probe and Pollution Probe were two quite separate organizations and for a long time different groups interested themselves in different ways about these issues. But now you can see they are together and people understand, and I mean my grandchildren and all kinds of other people, that you can save energy and save resources at the same time by recycling aluminum cans. And they think that that's an interesting thing to do. Let me try to give you some feeling of what I think are the major social and economic trends that are going to change our view about energy.

Almost all of us have been born in and have grown up with the feeling that we live in the industrial era. We talk about the industrialized countries of the west, even though a lot of the industry is not being done here anymore. Some of us remember when black smoke coming out of factory chimneys was a great sign of a triumphant economy. You could look at all that smoke making money, and people thought that that was really a symbol of what a successful society would look like -- Sheffield, East Toronto and so on. The piece of that rural, pre-industrial era had been blasted by an endless series of controlled fires and controlled explosions that drove assembly lines and lathes and looms until all of this seemed natural. You have to consume vast amounts of energy to make any kind of interesting society at all.

As a futurist, I'm inclined to say this. In the post-industrial economy, which we are entering very fast and in some measures are already 30 years into, intelligence plays the part that energy had in the industrial era. Intelligence is the driver, or prime mover, or energizer of the economy. Intelligence needs very little energy. It needs a lightbulb, a telephone, information, and communications, but it does not consume enormous amounts of energy. In this last year, Canada has used about the same amount of energy per unit of output in the economy as it was using sometime in the last century before we really industrialized. We have gone over a peak. We are looking in some ways at the same kind of society, in most ways a very different one. It takes no more energy to run a personal computer than it takes to read a book after the sun has gone down. A video cassette player uses about the energy of the lightbulb in the fridge. I figured out one day that when television broadcasts the Stanley Cup Final to the nation, it uses about 10,000 kilowatt hours or roughly one cent of energy for every one hundred viewers.

We're talking about enormously powerful technologies which use very little energy. And that's the first of nine trends, because that will continue. We are generally speaking on a downward trend economically in the use of energy and we will use less, that's a most obvious thing. And our output has reduced. Although per capita energy use is still on a very level basis in general, energy per unit of output is going down and we can see this happening due to several causes -- more efficient industry, and relatively less industry in the economic mix in Canada, and more efficient transportation.

The second trend is the globalizing of the economy. I don't know whether to call that a social trend , but it affects us socially so I don't know why I shouldn't. It means that more of Canada's manufacturing required by us as consumers is being done overseas. Year by year, more of what we consume is not manufactured here. It means, therefore, that more of our own economy is being concentrated into service activities because we have a comparative advantage in the creation of services, and they use much less energy per unit of output than does industry, and indeed much less energy per dollar of output.

The third trend is that since we started to deindustrialize, which by my reckoning is since 1953, our economic growth has been slowing down. In 1953 and before and slightly after then, we had the same kind of economic growth rates as South Korea or Taiwan. We were at the peak of our industrial power. Eight percent a year, seven percent, a bad year was only four percent, five percent, and we are now down to where three percent looks like a good deal, and one percent is bearable. And I would guess that by the end of the century it would be normal to think of two percent growth, and all of that means that the growth of energy use will slow down.

The fourth trend is what has happened in the world of work. We got rich in the post-war years, we became affluent. Work has always in the past consumed more energy than leisure. That could change, but I don't yet see any trends in that direction. And what is happening now is that office work, the work that most of us do, is becoming more like home life from the point of view of energy consumption and energy cost, although it is still more expensive. And, as a result, again, a reduction in the consumption of energy. One trend that people can see is that as work life becomes more like home life, the two will become more integrated. Already, something between 10 and 15 percent of Canadian workers are working at home, and my guess is that although probably not the number of workers at home will double, but the amount of work that is done at home will increase substantially until perhaps at the beginning of the next century, some point in the first decade of the next century, something like a third of all work will be done at home, or away from the office. A major saving in transportation, and a very small cost in communication. And there is a strong tendency, although you haven't noticed in the last two years, to work less altogether. And that is to spend less time at work, and in general not to consume the energy that is used at work.

The fifth trend is this. We have been saying as futurists for as many years as I can remember that a de-industrializing or a post-industrial economy and society will be decentralized. We will be able to run insurance companies in distant places, we have no need for the whole financial sectors to be concentrated in a very few streets, in a very few cities, and we will just see a gradual removal from the high cost of managing and running big cities. It isn't happening; quite the opposite is happening. The regions around Metropolitan Toronto have been growing population-wise in this decade at between 10 and 30 percent a year, depending on which region you are looking at. People are concentrating around Toronto. In the regions around that concentration, farther out to Newmarket and Barrie, they are still growing at five to ten percent a year, as the regions around Ottawa are. Everywhere else in Ontario, and right across the country, the growth of population is less than five percent a year; in many areas it is negative. Particularly in the northern parts of our provinces, government support at the federal and provincial levels generally is to pull in from the thinly populated areas and to support activities in the most populated areas. One effect of that will be to cut down the amount of transportation. We are in effect shutting down the north.

Why that is happening is a very good question. We are not just urbanizing, but metropolitanizing. The question worth asking is whether you think it will continue for another ten to twenty years. My answer would generally be yes, that education is one of the reasons people concentrate in cities because they find high class information, using the word information in the broadest sense, very good book stores, very good research facilities, very good theatre, etc.. Leisure is another good cause. People will concentrate where there is high class fun, food, and wealth. The best jobs, the most choice, and the best shopping. And what could change that trend? You can think of anything you want in the way of much enlarged satellite television, cellular phones, cellular fax, and so on, and I cannot see that overcoming this kind of social desire to meet in metropolitan centres. The question is can you imagine great entrepreneurial opportunities opening out in the backwoods? The answer is no. If you ask modern man and modern woman what they are looking for, the answer is entrepreneurial opportunities and social opportunities.

The sixth trend is the demographics. We are going to be a middle-aging society for the foreseeable future at least for fifty years. Middle aged people tend to drive rather than ride, like to be warm rather than cool, but on the whole they are likely to use less energy both directly and in what they buy and consume indirectly.

The seventh trend is the growing importance and stature of women in public life and in the commercial life as well. This can probably lead to more conserving of energy. In general, in the past women have been notably more sensible about avoiding waste and reusing things, although there are exceptions to that. The impact of feminizing the society and feminizing the economy is really more bound up in the whole de-industrialization process and will probably follow there.

The last trend is the environment. A lot has already been said this morning about the greenhouse effect, the heating up of the atmosphere, and so on, and we are going to hear more of that both here and hereafter.

I want to finish where I started by saying that as the economy has globalized, so too the environment is global. It's easy for us to think that we are solving Canada's problems by pushing manufacturing and all its energy consumption offshore. And in fact all our good stats show exactly that. That we have achieved some substantial reductions in energy consumption per unit of output precisely because the work is being done elsewhere. But the environmental effect is still rebounding. That is, whether the factory that builds my automobile is in Ontario or in Taiwan ultimately makes no difference if it pushes the same amount of energy into the atmosphere because the whole system is one closed cycling system. We can be as economical in energy use as we want in Ontario or in Canada, we can do everything we can to reduce the greenhouse effect, but as long as we encourage and allow third world countries to do our manufacturing for us and, believe me, many of them are not in the least interested yet in solving pollution problems, then we will see an increase in hydrocarbons in the atmosphere and it will redound to us.

I am very gloomy about our ability to solve those problems, certainly in the time that's left to us, and I think the accords that have been signed internationally are probably too little and too late. About the only solution that I would offer as a futurist is one that would get me thrown out of this room, and that is to cut back. Live a lower standard of living, or a less consumptive standard of living. Ultimately, that is the message we will get, and we are already beginning to get it from our younger generations. So those are the trends that I would see. We can resolve most of the problems locally, but globally I don't think we can.

GOLDFARB CONSULTANTS

PUBLIC ATTITUDES ON ONTARIO'S ENERGY CHOICES

by
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REMARKS TO THE CONFERENCE ON ONTARIO'S ENERGY CHOICES,

APRIL 3, 1989

CHECK AGAINST DELIVERY

I would like to talk to you tonight about public attitudes towards Ontario's energy choices. I have chosen this topic because I believe it is important for people who comment on energy issues, be they industry representatives, spokespersons for special interest groups, or politicians, to understand the concerns of the general public with respect to energy issues and the values they want the public and private sectors to apply in making energy choices.

This understanding is important, not because I believe that decision-makers must automatically do what public opinion polls tell us the public want government to do, but because I believe that it is important for decision-makers to understand the public attitude environment in which decisions, once made, are to be implemented. It is foolhardy for public or private sector decision-makers to ignore the reality of public opinion when they make energy choices.

My comments tonight are based on the results of a number of studies which Goldfarb Consultants has done in recent years for a variety of public and private sector clients. While the short period of time available to me this evening prevents me from presenting detailed, numerical data to support the points I will make, I assure you that Goldfarb Consultants has a significant amount of data to backup each of the points I will make.

I intend to address three issues this evening. First, to comment on the goals and values of the average Ontarian in terms of how they impact on energy choices. Second, to say a few words about public attitudes toward new energy projects, particularly as they are related to the generation of electricity. Finally, I will say a few words about the issue of leadership and the role each of us in this room must play with respect to reaching a public understanding on Ontario's energy choices.

First, with respect to the values of Ontarians, we need to understand, and appreciate, the importance of two things.

The first is the value residents of this province attach to all of the modern conveniences which their high incomes and high standard of living make possible. If you ask Ontarians what things they value most, other than good health and a close family, they place their highest value on owning their own home - preferably a single family detached home - and owning as many as possible of the appliances which make living in such a home so comfortable. Ontarian's want microwaves, dishwashers, freezers, several television sets, and preferably a pool, to go along with their single family, detached home.

Moreover, they value these things more highly than they value becoming powerful, becoming rich, or even having many close friends. In fact, in contrast to American values, Ontarians place a significantly higher value on the home they own, and the conveniences it has, than they do on owning an expensive car, dressing in expensive clothes, or making lots of money.

I emphasize these goals tonight because to make it possible for Ontarians to actually achieve their goals they not only need a good job and a significant income, but they also need adequate energy - energy to heat their home, energy to air condition it and electricity to operate its appliances.

Ontarians also believe that abundant, reasonably priced energy is also required for another reason - to enable the economy to keep growing and to ensure continued growth in employment. This growth in the economy and employment is essential if residents of this province are to get the jobs which will enable them to earn the income necessary for them to enjoy the quality of life they want.

I should also comment parenthetically that the significant difference between people living in Ontario and those living in some other provinces in Canada, such as Newfoundland, is that Ontarians expect to achieve their goals with respect to their high quality of life, while people in other parts of this country only dream about these goals. Therefore, the failure to ensure that adequate energy will be available to Ontarians will result in a significant public backlash due to failed expectations.

It is because of the central role which energy plays in making possible the achievement of the average Ontarian's desired lifestyle that reliability of energy supply is considered so essential. For example, when Ontarians are asked to rate a series of both public and private sector services, they rank electricity first, with virtually every single Ontarian saying that electricity is an essential service. In contrast, only 46% rate having natural gas available in their home as essential, and only 17% rate cable television as essential. Electricity is essential to the average Ontarian because without it they cannot achieve their most important goals and aspirations.

The essential character of electricity can also be seen when Ontarians are asked to explain what the phrase "a reliable supply of electricity" means to them. Two-thirds of the population say that this means that electricity must be available virtually every single time they want to use it - that is, that there is virtually never a power failure. Another 25% say that a reliable supply of electricity means that electricity is available almost all the time, except for once every two or three months when the power is shut off for less than an hour. Thus 90% of the population define a reliable supply of electricity using a standard of reliability which is not available in several Canadian provinces, including the neighbouring province of Quebec.

Indeed, our research data suggests that the people of this province would long ago have reacted strongly negatively to an electricity system which has as many disruptions in service and system breakdowns as those which occur in Quebec.

Moreover, since Ontarians have learned to expect an extremely reliable electricity system, and because they regard it as essential to achieving their ultimate goals and aspirations, they will react very negatively to a failure to maintain the current reliability of electricity supply in this province. The public reaction will be swift and strong against those who the public decide are responsible for a lowering of reliability standards for electricity in this province.

You may well ask yourself why I have stressed the importance of system and service reliability so strongly. I have done so not only because of its importance as a public attitude or value, but also because of the growing concern that the province may be starting to run out of electricity. In the past two years, there has been a doubling of the number of people who believe that the province has less generating capacity than it needs. There has also been a corresponding increase in the level of insecurity and concern about electricity supply. The issue of adequate electricity supply in Ontario is on the verge of becoming a major public and political issue.

Industry, in particular, is becoming very concerned about the electricity supply problem and its potential impact on their future investment decisions. Industry is now starting to believe that their investment plans may have to be curtailed if an increase in electricity supply is not achieved soon.

The second major value of the average Ontarian which is important to understand in making decisions about Ontario's energy choices is the value Ontarians place on protecting, and improving, our physical environment. Protection of the environment has, for several years now, been one of the three most important public issues throughout Canada. Its importance in Ontario is even greater than in some of the smaller provinces.

Ontarians are demanding that no further action be taken to hurt the environment and that action be taken to cleanup existing environmental problems. The public now expect companies to adopt proactive policies which ensure that environmental problems do not arise, rather than merely being reactive in responding to an environmental problem once it has arisen.

A clean environment is regarded as an essential component of the quality of life in Ontario. A clean environment is not something which is a passing fad. It has become deeply ingrained in the value structure of the average Ontarian, particularly among those who are under age 35. The importance of a clean environment as a public policy issue is here to stay.

Industry spokespersons who dream that concern about the environment will disappear, and that environmental regulation will be relaxed, are sadly mistaken. If anything, environmental regulations will be toughened and penalties against corporations and individuals who pollute the physical environment will be strengthened in the years ahead.

In part this will come about because the people of this province believe that in the last two decades, since government started taking action on the environment in the late 1960's, the condition of the physical environment in Ontario has actually worsened. In other words, the public believe that the environment is getting worse, not better, and that therefore tougher government action is needed.

Also, Ontarians do not believe that the quality of the environment needs to get worse simply because of the rate of economic growth in the province or because the average Ontarian is improving his/her standard of living. Ontarians believe that they can have a rapidly expanding economy, that their personal standard of living can improve, while at the same time having the quality of the physical environment improve.

Ontarians will not accept the proposition that the environment needs to be made worse if they are to achieve a better standard of living. This trade-off is one which Ontarians believe they should not have to make. They want to achieve both objectives. They believe that a clean environment, as well as a good standard of living, is a right to which they are entitled.

It is important therefore for us to ask what price Ontarians are prepared to pay, if any, to achieve an improved standard of living and an improved environment. The good news is that Ontarians would support somewhat higher energy rates if the higher rates would help to create a cleaner environment. The bad news is that the results of the research are somewhat discouraging to those of us who would support a strong energy conservation program.

Study after study of public attitudes on energy conservation show that relatively few Ontarians are prepared to make any significant sacrifice in terms of the amount of energy they use, or the time of day they use it, in order to reduce overall energy demand and thereby reduce the need for new energy projects, including electricity generating projects.

Ontarians reluctance to participate massively in conservation projects is due to several factors. First, they did not believe that the actions of a single individual can have any significant impact on overall demand and hence on the need for, or timing of, new energy projects.

Second, they believe that energy is reasonably priced, and so even if they were offered a price incentive to reduce demand, or shift the time of day of demand, the amount of money they would save is relatively insignificant in comparison with the inconvenience which would result from changing their current demand pattern. While financial incentives would have an impact on the amount of energy consumption, the size of the financial incentive which would be required in order to persuade people to take an energy conservation program seriously - an incentive in the range of 20-25% of current energy costs, such as a monthly electricity bill - means that a financial-incentive-based energy conservation program would be fiscally infeasible for an energy company to offer.

Third, there will be an extremely strong public reaction against any attempt to mandate an energy conservation program. The public believe that mandatory programs are wrong and that participation in any such program must be voluntary. In essence, the public believe that government should not dictate the value changes which would be the result of a mandatory energy conservation program, but that it is acceptable for government to offer incentives to persuade the public to change their values. Incentive-based demand management programs are acceptable; mandatory ones are not.

Finally, one parenthetical note with respect to the word conservation. When Ontarians are asked what they think the term "energy conservation" means, in almost equal numbers they give two distinctly different definitions. Half of the population say that energy conservation means using energy wisely, more efficiently and getting better value for money. The other half of the population says that energy conservation means doing without, suffering and not having the things they want in life. This second meaning of the term "energy conservation" is very negative because it suggests to the average Ontarian they will not be able to achieve the material things in life which they value so highly, and which I described a few minutes ago.

It is important therefore for all of us in this audience to understand that when we use the term energy conservation we are sending out two distinct messages. One is the message of efficiency and value for money, which is a very positive message. The other is doing without the things we want in life, which is a very negative message.

Since roughly half the population will interpret the term energy conservation according to each of these two definitions, people should ask themselves whether they want to emit such a confused message when they talk about energy conservation or whether they ought not to use another phrase which defines what they mean more precisely.

Let me then summarize the points I have made with respect to the values of the average Ontarian as they impact on this province's energy choices.

First, people in Ontario believe that their quality of life depends on many components: extremely reliable energy supply and a clean environment are two of the most important components.

Second, Ontario society is committed to acquiring all of the conveniences in life which require the use of energy to operate, and they want to be able to use these conveniences whenever they desire.

Third, consumers will not cut back on energy usage - except in an extreme crisis as we saw last summer at the time of the August 5th electricity supply shortage and as we saw at the time of the two OPEC oil shocks in the 1970's - because they do not think their individual decisions will have any significant impact on overall energy demand and because the level of inconvenience they would incur by reducing, or shifting, demand is such that they are not prepared to make this change in behaviour.

Fourth, Ontarians are prepared to pay somewhat more for energy if that is what is required to meet their two primary objectives of reliability of supply and a clean environment.

It is against this background of public attitudes that I would now like to make a few remarks with respect to energy supply options. My comments will be focussed specifically on the issue of electricity generation options, but many of my comments apply equally to other energy issues.

When Ontarians are asked to rank order their preferences for new sources of electricity generation, their preferred alternative is hydro power which many Ontarians, particularly those living in southern Ontario, believe the province has in abundant, untapped amounts. There is an erroneous perception in southern Ontario that much of northern Ontario consists of untapped rivers and lakes which could be dammed and used for electricity generation at no environmental cost.

As an aside, it is interesting to note that new hydro projects are not as acceptable elsewhere in the country as they are in Ontario. In British Columbia, for example, opposition to hydro power is much, much stronger than it is in Ontario.

When this hydro option is removed from consideration because it is not feasible - large untapped sources of hydro power do not exist in the province - and Ontarians are asked to rank order four other means of generating electricity - natural gas, nuclear power, purchased power from Manitoba or Quebec and coal - the results are as follows.

No matter how the question is asked, coal-fired generating stations are the worst of the four alternatives as far as the public is concerned. This is because they believe that coal is a major source of acid rain and acid rain is the number one environmental problem of concern to Ontarians. Therefore new coal generating facilities run directly counter to the clean environment objective I discussed earlier.

One can ask how the public might react to a coal-fired generating station if it was completely clean - that is, if it did not generate any acid rain. It is difficult to answer this question, primarily because it would require first convincing the public that it is technologically possible to build a completely clean coal-fired generating station. There would be sufficient public skepticism about this possibility that it is hard to assess how the public would react to the completely clean coal option. The public are so convinced that burning coal causes acid rain that a considerable public education program would be required before the public would believe that there is such a thing as a truly clean coal-fired plant.

Purchasing power from Quebec or Manitoba is the third most desired source of new electricity generation. While the public see considerable advantages in using purchased power - primarily that the environmental costs of electricity generation would be moved out of the province - they also see one significant drawback to the purchased power option: its impact on reliability.

As I have already described, the people of Ontario place an extremely high value on a reliable supply of electricity. They are reluctant therefore to put control of that supply in the hands of people not living in this province. While they understand that purchasing power from Quebec or Manitoba may be desirable for short periods, or in small amounts, they are reluctant to put their lifestyle at the mercy of people living outside the province.

In fact, when Ontarians are asked whether purchased power should come from Quebec or Manitoba, they overwhelmingly say that if power is to be purchased, then it should come in equal amounts from both provinces because that reduces the risk of power being interrupted, since it is unlikely that there would be major power problems in both Quebec and Manitoba simultaneously.

In short, using more technical language, Ontarians see purchased power as a reasonable option for peaking power but not for base load. Moreover, if power is to be purchased, it should be purchased from as many different sources as possible so as to reduce the dependence of the province on a single outside supplier.

The preferred source of electricity generation - the source which ranks first among the four tested - is natural gas-fired generating stations. This ranks slightly ahead of nuclear powered stations, even when respondents are given data with respect to the cost differences between natural gas generation and nuclear generation. The reason for this is that the public believe that natural gas generation is safe, clean and in abundant supply. There is, as yet, no linkage in the public mind between the burning of natural gas and the emerging environmental problem of CO_2 or the greenhouse effect.

Support for natural gas generation is tempered by two factors: its somewhat higher price than nuclear power - support for gas generation declines proportionally as the gap between the cost of nuclear and natural gas generated electricity increases - and the fact that natural gas comes from outside Ontario and therefore the reliability issue again becomes a factor. Nevertheless, the strong positive environmental image of natural gas is such that it attracts support among a large number of Ontarians as a means of generating electricity.

I must caution, however, that attitudes with respect to natural gas and coal generation involve one significant unknown. It is impossible to tell, at this time, what impact on public attitudes increased concern about the greenhouse effect will have.

If the greenhouse effect issue gains in public interest and public importance, as it may well do in the next decade, this could cause a significant weakening of public support for both coal - even clean coal - and natural gas electricity generation. But because so little is currently known about the greenhouse effect, and because it is currently an issue of concern only to a very limited number of Ontarians, one cannot forecast accurately how it will effect public attitudes towards electricity generation options in the future. One can safely predict, however, that in view of the importance which the public attach to a clean environment that if the greenhouse effect becomes a major environmental issue, then support for coal and natural gas electricity generation is likely to decline.

Finally, the second most preferred source of electricity generation is nuclear power, slightly behind natural gas generation, but considerably ahead of coal and purchased power. However, the nuclear option also generates the most emotional response among the various electricity generation options tested. The public are divided right down the middle on nuclear power: 50% favour building a new nuclear plant and 50% oppose such construction. Moreover, among the 50% who oppose construction for a new nuclear plant, 30% say that they would strongly oppose such a plant.

There are essentially two reasons why Ontarians are concerned about nuclear power. One is plant safety - the fear that a Chernobyl or Three Mile Island type of accident will occur in Ontario. The second reason for being concerned is nuclear waste. The public are concerned about how the waste problem will be handled and whether it will cause a problem for future generations.

It is interesting to note that the waste problem is of much greater concern to women than men. As is true with other inter-generational issues, women are more concerned about the nature of the world which will be left to their children than men are. This difference in the levels of concern between men and women on intergenerational issues is born out clearly in attitudes toward the nuclear waste issue.

There are two other interesting comments which should be made about the nuclear power issue. First is that far more people believe that Ontarians are opposed to a new nuclear power plant than are actually opposed to it. Indeed, the public perceives the opposition to a new nuclear power plant to be 30% greater than it actually is.

Equally interesting is the fact that more than three-quarters of Ontarians believe that the construction of a new nuclear station is inevitable. This level of public acceptability of the inevitability of a new nuclear plant is quite surprising.

Against this background of public attitudes toward electricity supply options in which the most overwhelmingly acceptable option - hydro power - is not feasible, and in which each of the other four options are regarded with varying degrees of misgiving by the average Ontarian, one must inevitably address the issue of whether demand management is not the solution to the problem of the need for new electricity supply.

Demand management is seen as a very positive thing - indeed the public expect Ontario Hydro to offer programs for the efficient use of electricity - but only to the extent that focussing on demand management, and thereby delaying the construction of new electricity generating facilities, does not put at risk the reliability objective. In other words, when respondents are asked whether the provincial government should focus primarily on increasing electricity supply, primarily on decreasing demand or on both equally, half of the respondents say that the primary focus of government policy should be on increasing supply, one-quarter of the respondents say that it should be on decreasing demand, and one-quarter say that the primary focus should be on equally increasing supply and decreasing demand.

When this issue was explored further, respondents make it clear that their concern with excessive reliance on demand management is that there is a risk that it will lead to a situation in which the forecasted level of electricity saving through demand management is not achieved and yet inadequate attention has been given to increasing supply, with the result that there will subsequently be a supply reliability problem.

For reasons I explained at the beginning of my remarks tonight, the public will not tolerate a shortage of electricity supply, nor will they tolerate a decline in the reliability of the current supply system. Hence the concern about excessive reliance on demand management.

In summary, on the issue of electricity supply, consumers, when they are given the relative cost of new supply options, prefer natural gas generation, slightly ahead of nuclear power and purchased power. But all three options have significant negative attributes attached to them.

The preferred option of reliance on more large scale hydro generation is not feasible - the untapped sources of hydro power do not exist - and the fourth option of increased coal generation meets extremely strong public resistance.

Demand management is seen as a positive thing, but only if it is integrated with ensuring adequate supply. Demand management programs, even though they can be positioned as helping to increase supply, must not put at risk the reliability objective.

When one combines the public values I described at the beginning of my talk with the points I have just made on public attitudes toward alternative sources of electricity generation, the following public policy challenge emerges:

- demand is expected to rise;
- it is essential that reliability of supply be maintained and that it be done so in a way which protects the environment;
- there is public anxiety about safety, security of supply, cost and the environmental impact of various supply options.
- the public policy challenge is to meet the two objectives of reliability of supply and a clean environment, while adequately addressing public concerns about safety and security of supply, and doing all of this in a way which does not cause electricity rates to increase dramatically.

This, in a nutshell, is the challenge facing decision-makers in the Ontario government, in Ontario Hydro, and in the various regulatory agencies which must give their approval before a decision is made as to how to meet future electricity demand.

Meeting this challenge will not be easy. It will not be easy because whatever decision is made will spark significant public debate. The electricity demand/ supply problem in Ontario is one in which every option sparks a negative reaction from some special interest group or other.

Every option has negative attributes. Yet one must be chosen. Trade-offs are required, and compromises must be made, if the problem is to be solved and the least negative option, or mix of options, is to be selected for implementation.

The electricity supply problem is one for which there is no "right" answer because the right answer depends very much on an individual's subjective set of values. There is no "right" answer in terms of an objective test of right or wrong.

What is clear from public attitude data, however, is that the public do not want an electricity supply problem to develop. Neither do they want the future reliability of electricity supply in Ontario put at risk through years of wrangling before regulatory agencies or the courts. Equally, the public are getting increasingly tired of simplistic, ideological based answers to tough public policy problems which are frequently put forward by both industry and special interest group representatives.

The time has come for a significant public consensus building effort on this tough public policy problem. The time has come for everyone with an interest in Ontario's energy choices to be willing to make a compromise in their own preferred solution for the overall public good.

Industry supporters of a particular technology for electricity generation who argue for their technology by ignoring its negative attributes - which industry spokesmen have frequently done over the years - will only exacerbate a difficult situation and not contribute usefully to its resolution. Similarly, spokespersons for special interest groups who take extreme positions, such as by proposing mandatory conservation or demand management measures which fly directly in the face of what the public wants, are being equally unhelpful.

As a former senior public official, both federally and provincially, the message I want to leave with you tonight is simply this: the people of this province face a very difficult choice with respect to the nature, and the timing of construction, of future electricity generating facilities. The difficulty of the choice stems largely from the fact that whatever option is chosen, it will be the least negative from a set of negative options. There is no entirely positive option available.

Public policy decisions made by choosing the lesser among a series of negative options are the most difficult issues to deal with because the public intensely dislikes having to accept such decisions. The public always wants to believe that a positive option exists if only decision makers would find it.

I would therefore plead with the people in this room not to exacerbate the difficulty of dealing with the problem of the need for new electricity generating capacity by taking extreme, ideologically based positions. I urge all of you to recognize that all of us, no matter what group in society we represent, must be prepared to make compromises in seeking a public understanding on, and a solution to, this most difficult public policy challenge. Making a decision to act in this way is the energy choice I hope all of you will reach as a result of this conference.

NOTES FOR
REMARKS BY

ROBERT C. WONG
MINISTER OF ENERGY

ONTARIO'S ENERGY CHOICES CONFERENCE

CIVIC BALLROOM
SHERATON CENTRE HOTEL
123 QUEEN ST. WEST
TORONTO
APRIL 4, 1989
12:45 P.M.

CHECK AGAINST DELIVERY

Good afternoon ladies and gentlemen. In my opening remarks to you yesterday, I welcomed you here as energy decision-makers, not just as conference participants.

The people of this province must make some energy choices that are both difficult and important. All of us must participate in making these choices because they will affect each of us personally.

Our choices will have direct effects on our economy, our environment, our life-styles, and on the overall quality of life for us and for generations to come.

Decisions of such importance require broad public support -- and as much of a consensus as possible. Creating that consensus will not be easy.

We must seek out a an energy path to sustainable development -- the kind of development that builds a bridge between economic expansion and consideration for the environment. To accomplish this, we must ensure that people throughout our entire society understand the fundamental nature of these choices.

As leaders in business and energy, you have an important, if not key role, in helping to raise people's awareness of the choices which face all of us.

We in Ontario are fortunate in that we do have choices. Ontario is Canada's largest energy consumer -- and our energy consumption has been growing. As our economy and population continue to grow, so will our energy needs.

By the year 2000, Ontario's residents are likely to be consuming 13 per cent more oil, 25 per cent more natural gas, and, in the absence of demand management measures, 39 per cent more electricity.

My mandate is to ensure that Ontario has adequate and secure supplies of energy at reasonable prices.

The questions I will ask about any proposed mix of energy options are:

- Do these choices enhance our industrial competitiveness and economic well-being?
- Are they sensitive to the needs of the environment?
- Do they provide Ontario with adequate and secure supplies of energy at reasonable prices?
- Do they address the merits of demand management?

To address the first question, do these choices enhance our industrial competitiveness and economic well-being?

With global trade increasing in importance, we must be competitive in world markets in order to survive and to maintain and improve our quality of life. Ontario depends heavily on trade — one third of this province's economic output goes outside the province.

Today, the world economy is in transition, moving from an industrial economy into an advanced global economy. This is a period marked by rapid change and intense competition as trade barriers fall all around the world. It is a time of opportunity. It is also a time of risk.

Can we maintain our trading position? Some of the answers to that question can be found in a report called "Competing in the New Global Economy" which was produced by the Premier's Council.

Their message is clear: Ontario's economic future is at risk unless we adapt quickly to new rules shaping global economic development.

Adapting to those rules will require technical innovation, a better-trained work force, more effective marketing, and higher productivity. It will also require a secure supply of reasonably priced energy.

Because our economy is energy-intensive, we have an uphill battle in reducing the energy cost component of many of our products. In many important industries, including pulp and paper, chemicals, and primary metals, energy costs can account for more than 20 per cent of total costs.

That emphasizes the importance of energy in our economic situation. Energy is the force that drives Ontario's economic engine.

The cost and availability of energy and the efficiency with which we use it can make the difference between industries that can make the grade in international and domestic markets and those that will be left behind.

The energy choices we will make on both the demand and supply sides, will help to determine the competitiveness of our economy and have a long-term impact on the quality of life in this province.

But economic considerations alone are not enough.

The second consideration is: Will our energy choices be sensitive to the needs of the environment?

There was a time, not so long ago, when economic considerations alone determined our energy choices. Sometimes it's hard to believe that it was less than 30 years ago when the book "Silent Spring" appeared and made us aware of the environmental drawbacks of using DDT.

Today, our increased knowledge of the environment means that everything we do must be examined from the perspective of its environmental impact.

We are certainly more conscious of the effects of energy production and use on the environment with global warming or the greenhouse effect being the most topical example of the disadvantages of our reliance on fossil fuels.

It is clear, as the Kierans report -- Energy and Canadians: into the 21st Century -- pointed out, that environmental goals should be accorded the same importance as other economic and social goals in the planning, development and use of energy.

Let's turn to the third consideration: Do our choices provide Ontario with adequate and secure supplies of energy at reasonable prices?

Most of the oil, gas and coal we use comes from outside the province. Our ability to influence development of these new supplies is limited. Furthermore, world market forces, over which we have no control, could push energy prices up again.

So we expect to gain little influence over such supplies. In fact, with the advent of deregulation and competitive markets, the influence of governments over supplies of oil and gas is likely to diminish.

I believe, however, that Ontario consumers must have access to a range of alternative supplies for our market to function properly. We will continue to intervene in regulatory proceedings to present Ontario's position and to protect the interests of our consumers.

Electricity supply, on the other hand, is an issue we can control. That makes electricity supply one of the key energy issues in Ontario. Our demand is growing; it has grown by 32 per cent in the past six years.

And it will continue to grow. Forecasts indicate that new supply will be needed within the next decade to meet demand, even if we successfully attain our demand management targets.

One thing we must not lose sight of is the fact that reduction in demand is, in effect, new supply. In this light, we can and must continue to act to use our electricity supplies more efficiently.

On the fourth consideration: Do our proposed mix of energy options address the merits of demand management?

As Minister of Energy, I have set priorities accordingly. My first priorities are conservation and energy efficiency. Both have have economic and environmental advantages.

Making better use of our energy -- doing the same amount of productive work with less energy -- helps increase our international competitiveness. And controlling the growth in demand for energy helps reduce the environmental impact of our energy production and use.

Let me give you some examples of actions we have taken.

We have sharpened the focus on electricity demand management programs. I recently introduced amendments to the Power Corporation Act to empower Ontario Hydro to intensify its efforts in electricity conservation and efficiency programs.

Hydro has set a goal of a 5,500-megawatt savings from conservation, efficiency and parallel generation measures by the year 2000. This is shaving the anticipated growth in demand by about one-half, and is roughly equivalent to the output of one-and-a-half major, new generating stations.

And, we at the ministry, are helping Ontario municipalities, large building owners, householders, consumers, industry and agriculture to reduce their energy consumption through programs that assist them to implement energy-efficient measures.

But our programs aren't sufficient on their own. I look upon them as catalysts for broad-based conservation campaigns -- campaigns that can, and I believe will, be remarkably successful in reducing our demand and increasing our energy efficiency.

Those of you who heard Senator Michael Kirby's report yesterday know that demand management has an important role to play.

Our biggest collective challenge will be to change people's attitudes and create a widespread desire to use energy more efficiently.

In fact, people are beginning to understand that using energy more wisely can protect and preserve our environment.

Attitudes can be changed. We've all been impressed by the way blue boxes have appeared all over the province as people suddenly became aware that waste management is a problem that can only be solved by starting in the home.

Hydro President Bob Franklin put his finger on the issue in a recent speech to the Municipal Electric Association. He said, and I quote, "Twenty years ago, the simple solution was to expand supply by building more generating stations."

"We thought that was the way to meet our customers needs. In fact we were simply following our customers' lead. Now the shoe is on the other foot. We have to lead our customers - to where they want to go." End of quote.

That's the approach all decision-makers in the energy field will have to take -- show leadership. It's a challenge that I am asking each of you to take up -- to go to the public, to business executives, to governments and communicate to them about demand management.

Demand management is not a short-term program designed simply to get us through a crunch in electricity supply in the 1990s. Environmentally, economically, and socially, it makes sense and should be part of our mix of energy options on a permanent basis.

Now, let us move from looking at these general consideration to looking at specific issues. Forecasts indicate that supply in the 1990s will be needed. And the question of when a commitment is needed on new, major sources of electricity supply has become increasingly important.

I believe we must plan our needs carefully and come to a consensus on the system we want -- as expeditiously as possible. All of us have to recognize that the people of Ontario will accept the need for new, major sources of electricity supply only if they are convinced that all other cost-effective and environmentally acceptable options have been explored.

What do I mean by an environmentally acceptable option?

For that, I turn to the report of the Brundtland Commission and the concept of sustainable development -- development that "seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future."

Ultimately, the world must find a low energy path to sustainable development. That will take time. In the interim, no doors should be closed provided that all due care is taken in energy use.

When I attend meetings of the Premier's Round Table on the Environment and the Economy, I promote demand management and energy efficiency for both the environmental and economic contributions they make.

And, on the supply side, I believe, as does the Select Committee on Energy that no supply option should be ruled out until the relative benefits and costs of each have been determined.

We are reviewing our options. Keep in mind when I list them that these options should not be regarded as mutually exclusive. A combination of options is possible, especially in view of the fact that each option will be different in terms of size and cost as well as the amount of time each will take to provide electricity for users.

Those options are:

- a new major generating station powered by coal, oil, gas, or nuclear power,
- enhancing the supply from existing generating stations,
- purchasing electricity from Manitoba or Quebec, and
- non-utility generation.

I have a number of comments to make about some of these options.

In non-utility generation, we have encouraged small hydro development, energy from biomass and waste, and cogeneration.

There are 23 private generators supplying power today. Another 78 are at the proposal stage. About four per cent of our electricity is privately generated today and we estimate private generators could produce more than 2,000 megawatts by the year 2000.

The Non-Utility Generation Advisory Council, with representation from Ontario Hydro, power associations, private companies, and my ministry, is helping us develop policies for non-utility generation, including pricing policies.

Cogeneration has appealing advantages. It can capture up to 80 or 90 per cent of the energy from a primary fuel when it is used to produce both heat and electricity, better than the 33 per cent we capture in generating electricity alone.

Cogeneration based on natural gas offers both energy and environmental benefits. In fact, if natural gas were used solely for electricity production, the environmental benefits would be significant.

In fact, Ontario Hydro is seriously considering participation with the private sector in the production of new electricity supplies from natural gas. I am confident that a timely and competitive endeavour will emerge from these discussions.

We could purchase electricity from Quebec or Manitoba. Ontario Hydro is in the midst of negotiations with these provinces. There are some advantages to purchase, provided the price is competitive and the reliability is secure.

The disadvantages are that we lose some of our control, and that the economic spin-off from the development of electricity sources will not occur in Ontario.

While we have already developed all our suitable large hydro sites in Ontario, with the exception of new development at Niagara Falls -- which will make it possible to generate another 700 megawatts -- we can enhance the supply of electricity from these sources from neighboring provinces.

And we have been encouraging Ontario Hydro to examine the introduction of new combined cycle plants at some of the mothballed coal or coal/gas stations. Combined cycle plants can capture roughly 45 per cent of the primary energy, as opposed to a third for conventional generation.

Then, there is the option of building a major new generating facility. Within that option, there are also choices.

A new nuclear generating station is clearly a possibility. The existing nuclear stations produce about half of our electricity, efficiently and safely.

The Government asked Professor Kenneth Hare of the University of Toronto to examine the safety of the reactors.

His report was favorable, stating that nuclear-generated electricity has no significant adverse impact on the work force or the public, and that the possibility of an accident serious enough to affect the public is very remote.

The Government also commissioned an independent study of the costs of Candu reactors. It is one of a series of reports on the costs of generating electricity using various fuels.

I am pleased to be able to release the Candu costs report today. It represents one step in the Government's ongoing commitment to gather all the necessary information on which to base the best possible decision about the future of our electricity system.

Other steps are being taken by Ontario Hydro. Hydro will be undertaking further costs studies of the alternatives to nuclear generated electricity.

Oil-fired, gas-fired, and coal-fired generating stations are among our options. Coal is used to generate one-quarter of the electricity in Ontario and if we are obliged to build a new facility, we should consider clean coal technology.

In addition, Ontario Hydro will spend $2.5 billion to install scrubbers and other pollution control measures at its coal-fired plants. We are cooperating with the coal-producing provinces and the federal government to improve the quality of Western Canadian coal and to lower its delivered cost to Ontario.

To sum up, this is where we are today. The Select Committee on Energy has examined many aspects of our energy situation and policy.

We in government have given Ontario Hydro explicit direction to make energy efficiency its first priority and we have undertaken three reviews of Hydro's draft Demand/Supply Planning Strategy.

We have, as I mentioned earlier, examined the safety and the costs of our Candu reactors.

With the studies of the costs of alternatives to nuclear power, and an independent review of those studies, we will be in a better position to evaluate our electricity supply options against the requirements of assisting Ontario's economy and preserving the environment.

And my ministry has initiated a new forecast of Ontario's future energy demand up to the year 2005, taking account of the expected growth of Ontario's economy.

The time has come to involve the public. This conference is part of that process and it will be followed by regional conferences in Sudbury and Ottawa.

These will provide more opportunities for public involvement and consultation. They will prepare the ground for a decision by building a consensus on the options that will best suit our social, environmental and economic needs.

I expect our policy will include a mix of options. Demand management and conservation will be an important part of it. Supply options will also play a role in ensuring that we have adequate amounts of energy at reasonable cost.

There are trade-offs to be made -- and we must choose carefully. Our quality of life and that of future generations will depend on how well we balance demand and supply.

Energy drives our economy. It has a direct effect on our competitiveness in world markets. And it has an impact on our environment. Each of us will benefit from coming to a consensus that will help secure our future in the world and in our province.

You are key decision-makers. As leaders in your industries and fields, you can help build the consensus we need.

Together, we can ensure the best of all possible energy futures for Ontario.

Thank you.

THE COAL OPTION:
U.S. EXPERIENCE AND OUTLOOK

Presentation to
ONTARIO'S ENERGY CHOICES CONFERENCE
TORONTO, ONTARIO

APRIL 3, 1989

by
A. DENNY ELLERMAN
VICE PRESIDENT
CHARLES RIVER ASSOCIATES
WASHINGTON, D.C.

COAL USE HAS INCREASED

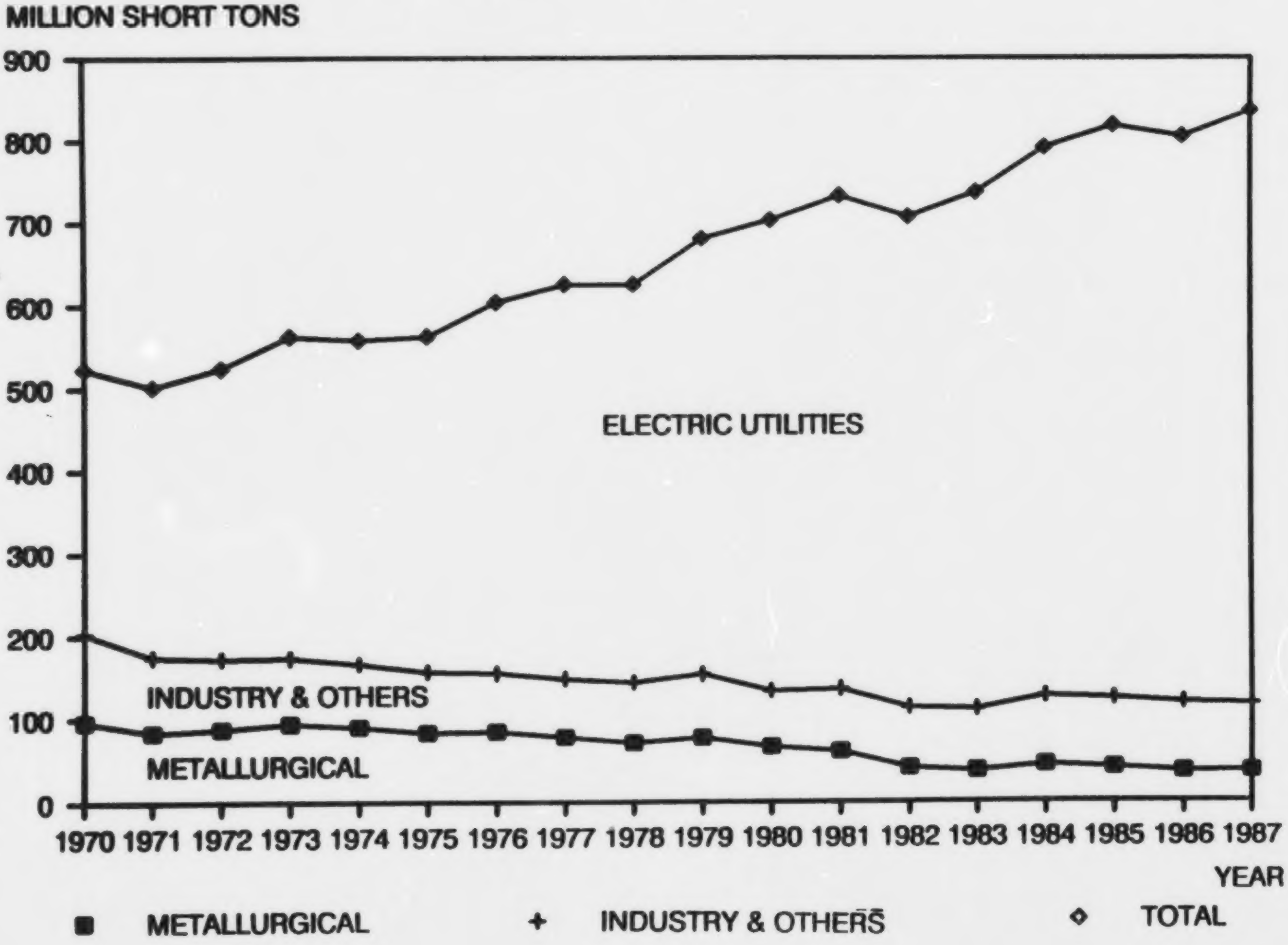
Driven by Electric Utility Sector

- Continued Demand Growth
- Strong Substitution for Residual Fuel and Natural Gas

Declining Metallurgical Coal Use

Slight Growth in Industrial/Other

U.S. COAL USE
CUMULATIVE MILLION SHORT TONS



PRODUCTIVITY AND PRICES

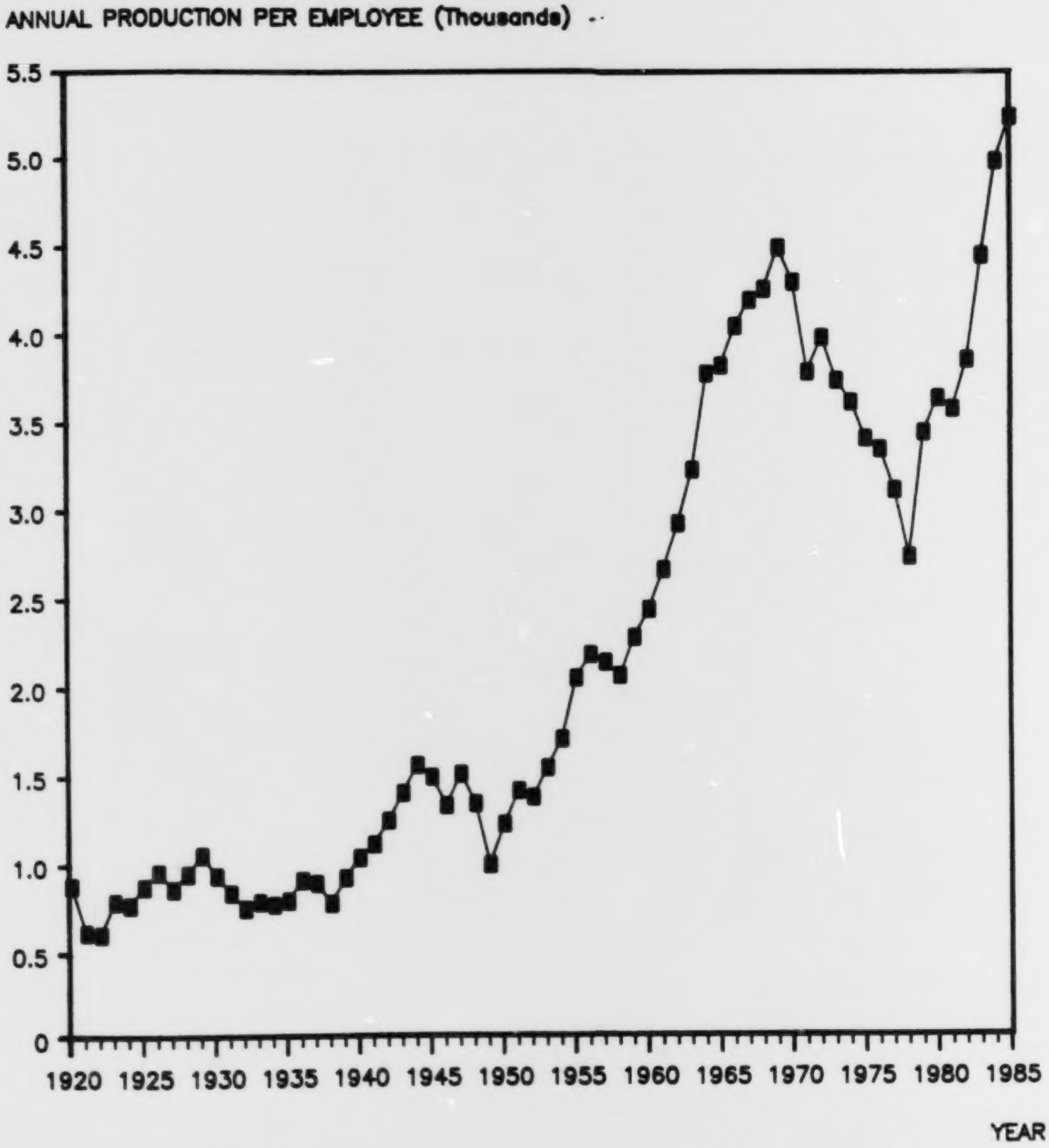
Sharp Break in Productivity Growth in 1970s

- Internalized Regulatory Costs
- Real Factor Cost Increases
- Energy Crisis Euphoria - Lax Management

Highly Competitive Industry

Prices Reflect Changes in Production Costs (e.g., Productivity)

EMPLOYEE PRODUCTIVITY IN THE BITUMINOUS COAL MINING INDUSTRY: 1920-1985

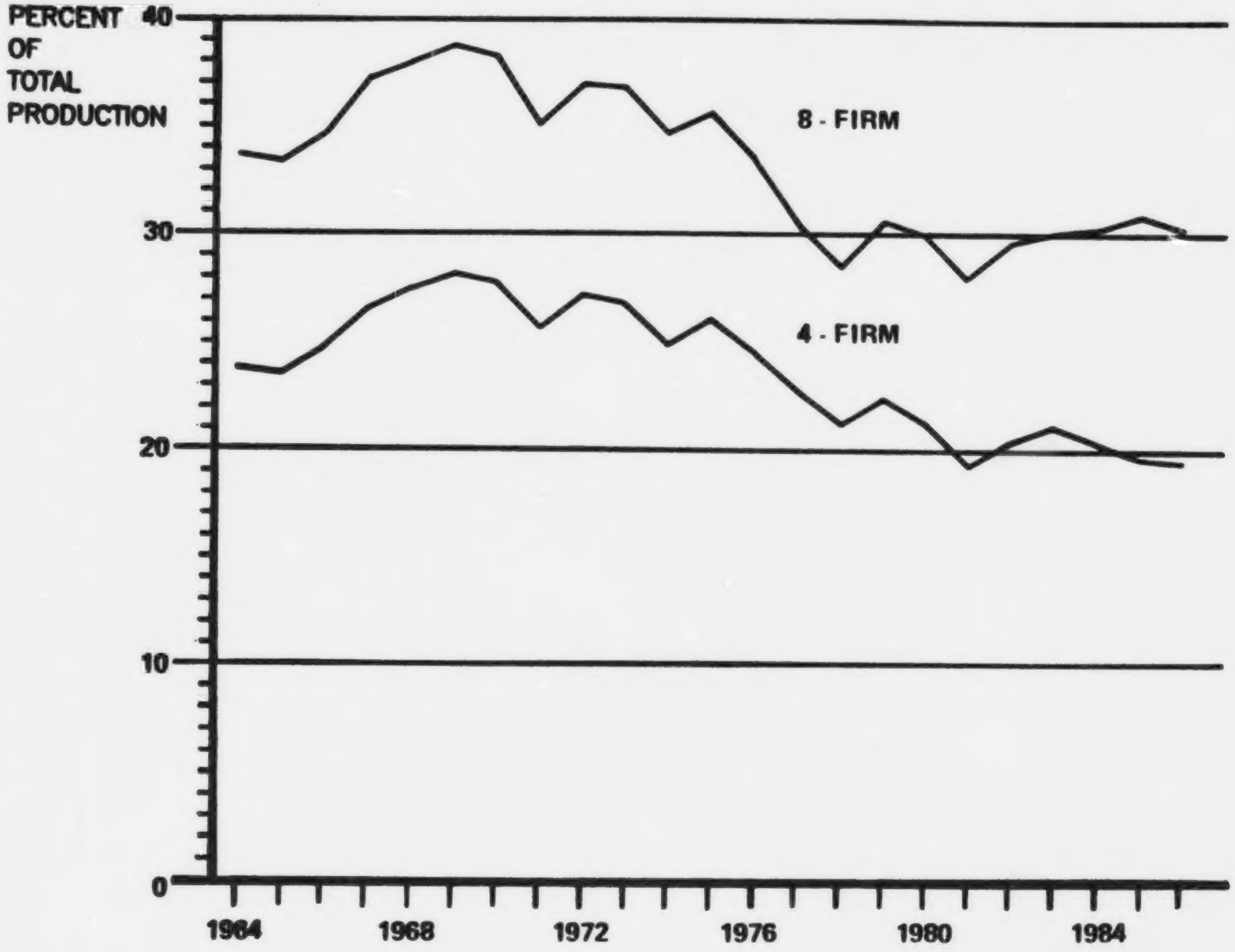


SOURCES: CRA calculations adapted from:

1) National Coal Association. Coal Facts. 1974–75 edition; and

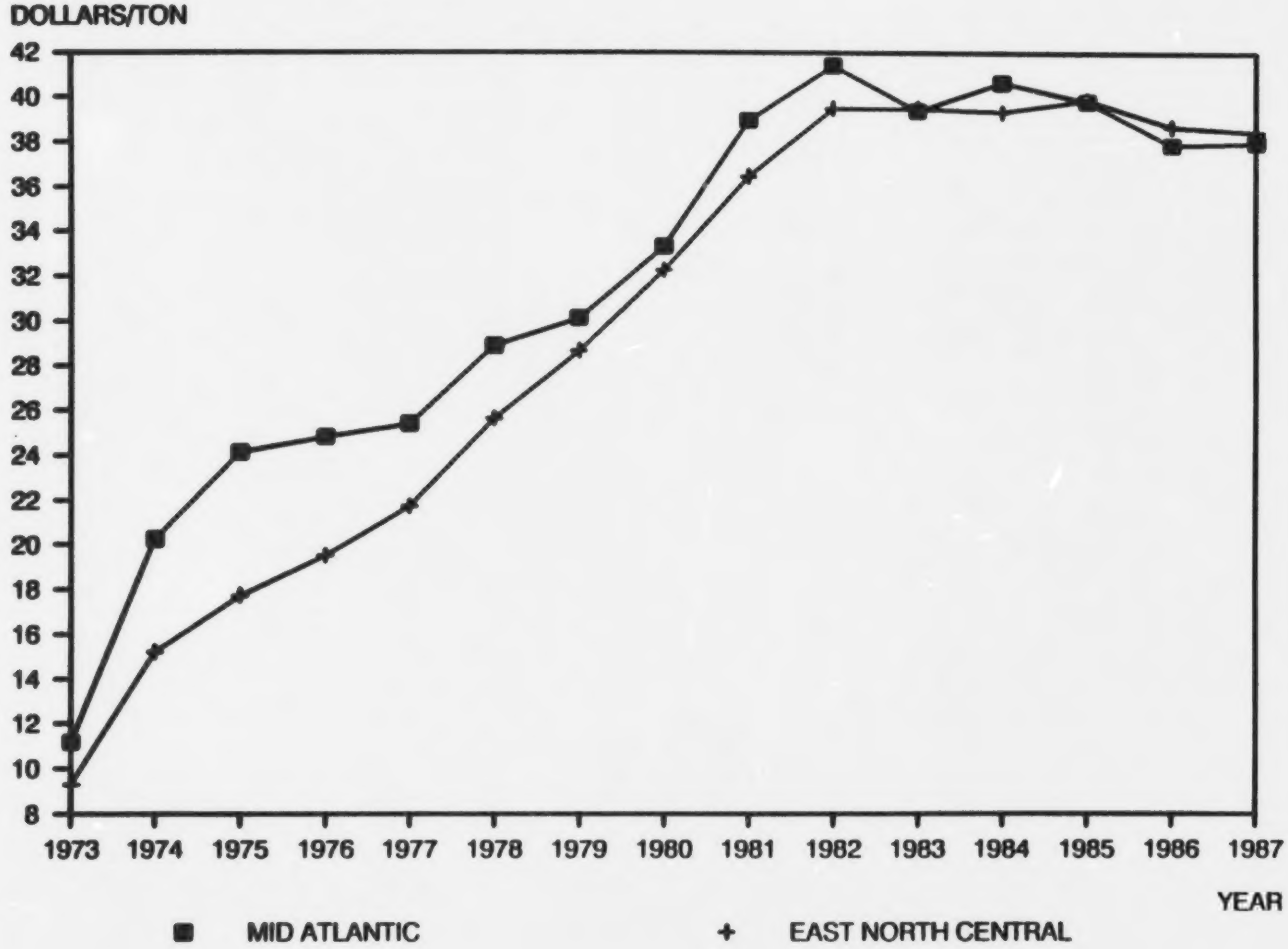
2) National Coal Association. Coal Data. 1978, 1979–80, and 1987 editions.

U.S. COAL PRODUCTION CONCENTRATION RATIOS: 1964-1986

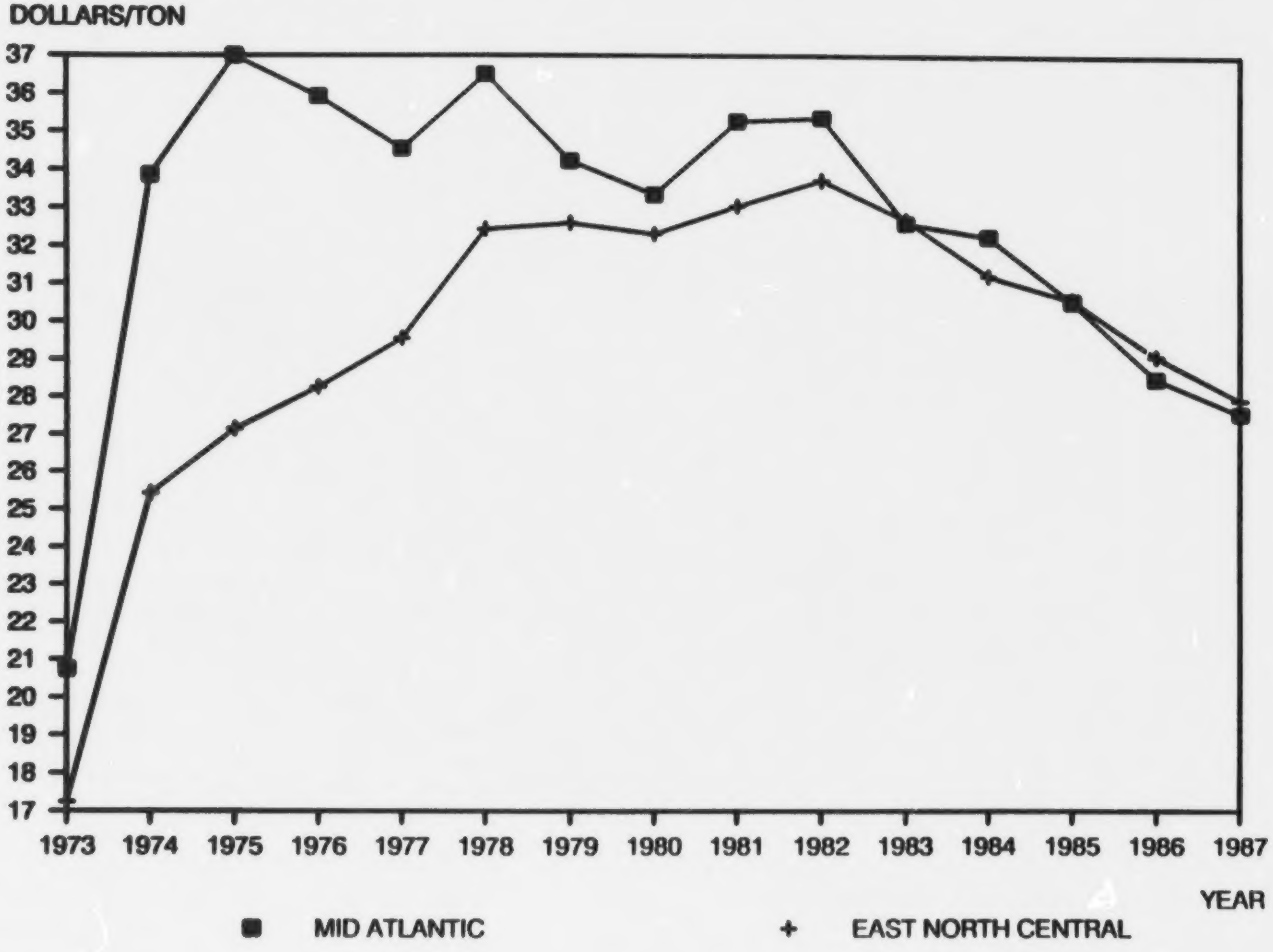


SOURCE: U.S. Energy Information Administration. The Changing Structure of the U.S. Coal Industry, 1976–1986. DOE/EIA–0513, 1988, p. 8.

DELIVERED COAL PRICES
NOMINAL DOLLARS/TON



DELIVERED COAL PRICES
REAL DOLLARS/TON



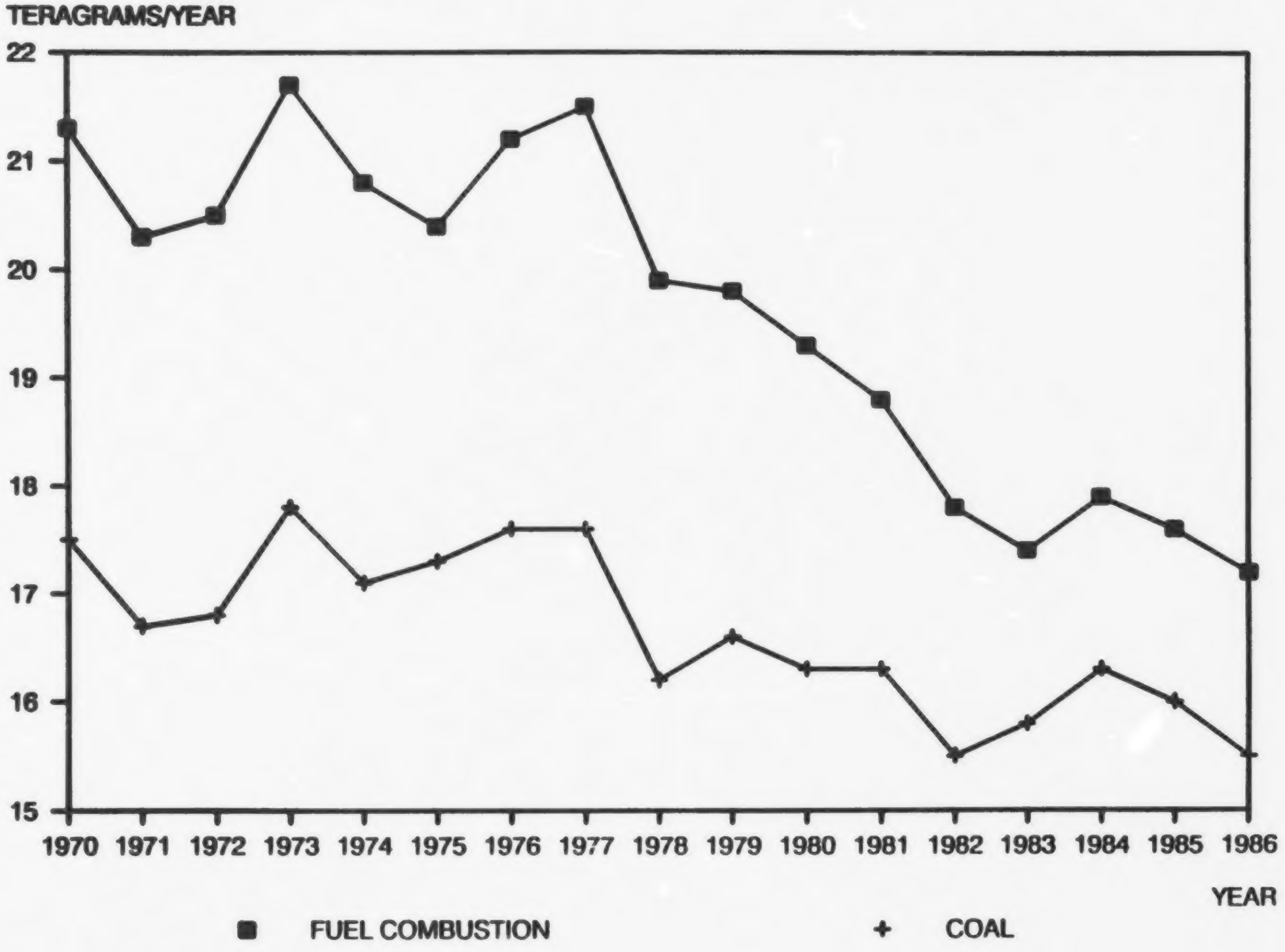
SO_2 EMISSIONS HAVE DECLINED

Despite Significant Increase in Coal Use

Decline in Emissions Rate Greater than Increase in Use

- Regulations
- Changing Use Patterns (Lower-Sulfur Coals)

SULFUR OXIDE EMISSIONS FROM FUEL COMBUSTION



OUTLOOK

Continued but Slower Growth in Coal Use

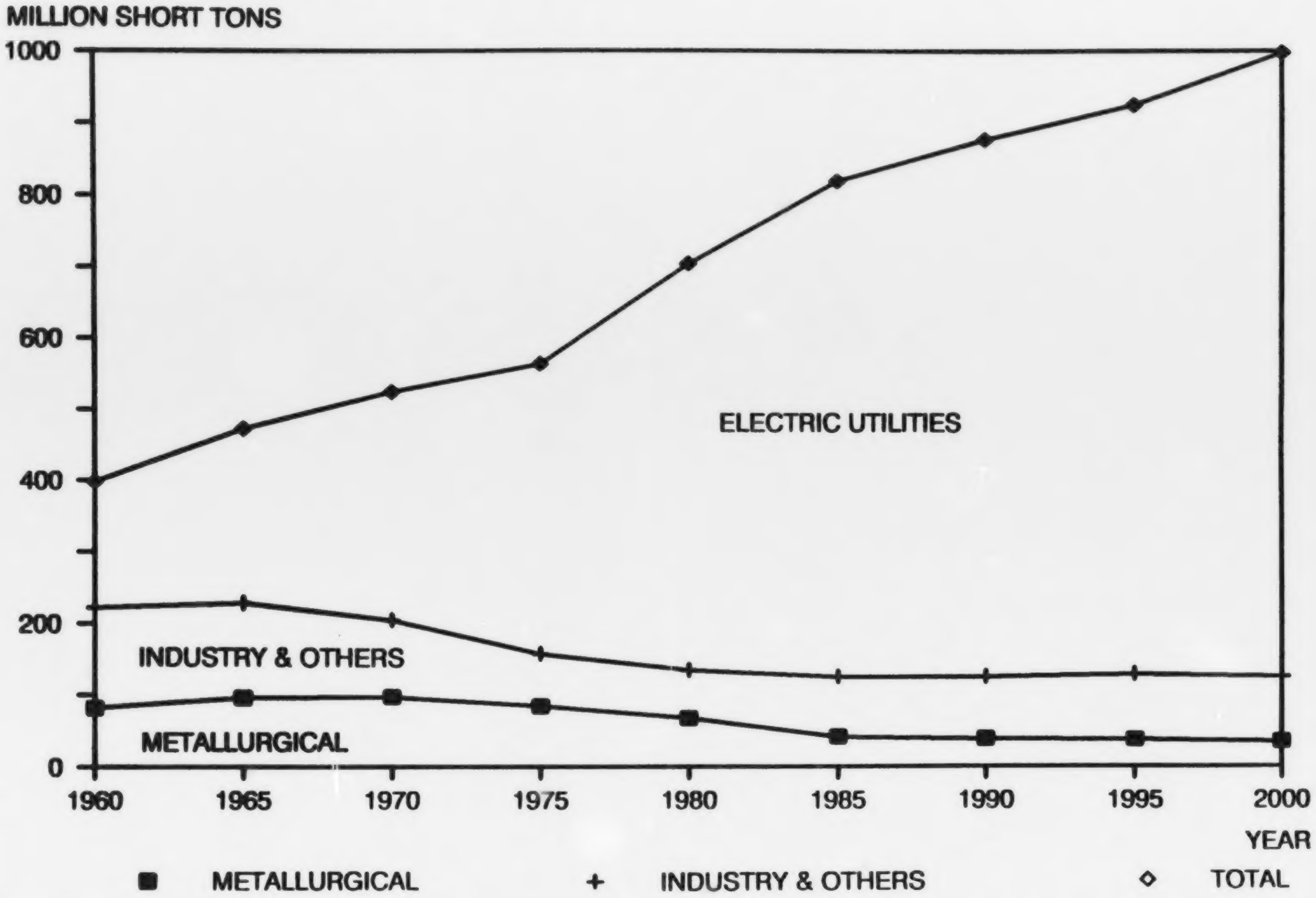
- 2.8% P.A. 1970-1987 (Actual)
- 0.9-1.8% P.A. 1987-2000 (Forecast, NCA)

Constant or Declining Real Prices

- Slower but Continued Productivity Improvement

Steady to Declining SO_2 Emissions (w/o Acid Rain Legislation)

U.S. COAL USE VS. FORECAST USE
CUMULATIVE MILLION SHORT TONS



INTERFUEL COMPETITION

Natural Gas Is Chief Threat to Increasing Utility Use of Coal

Major Factors Determining Coal/Gas Fuel Choice

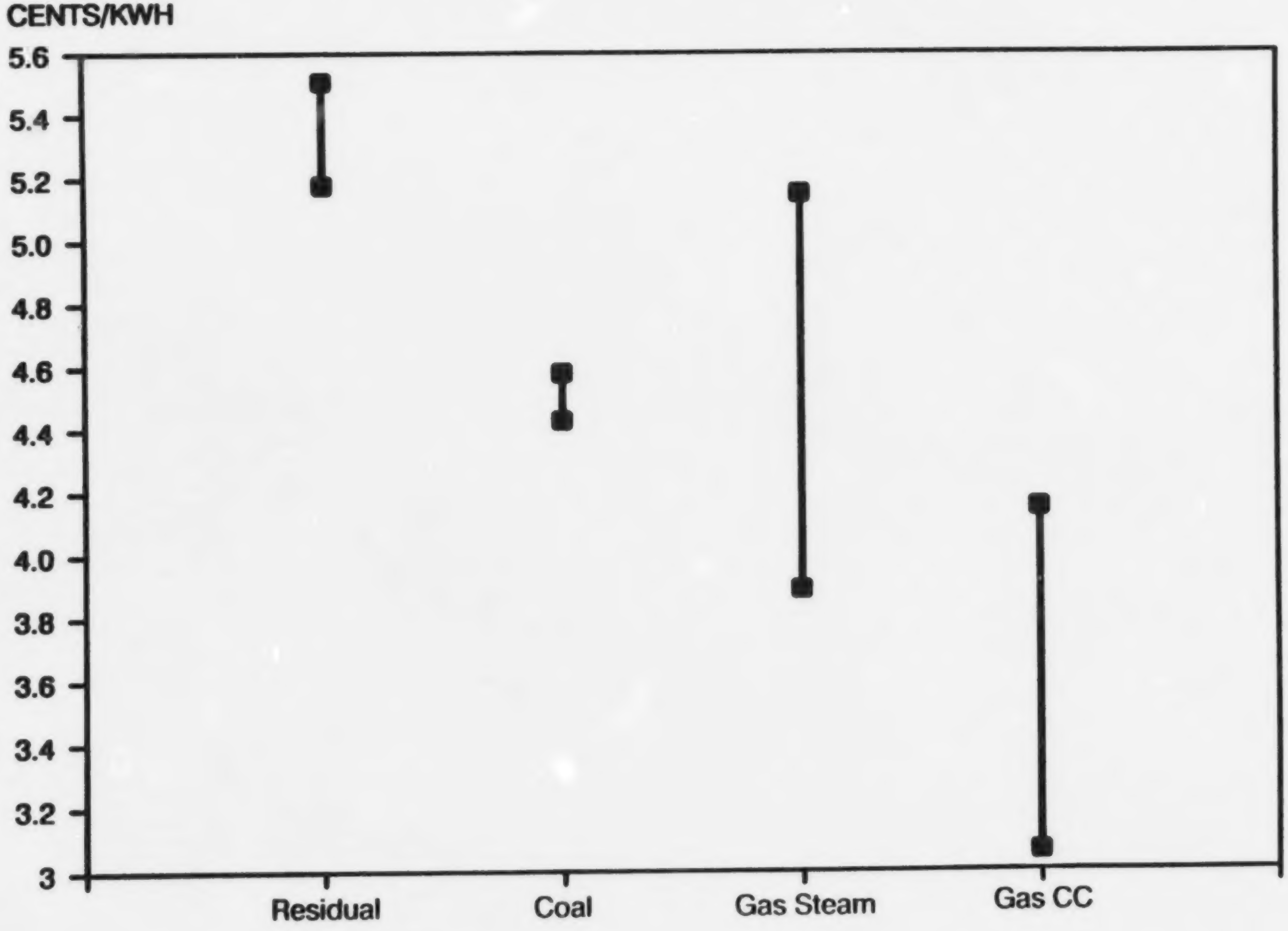
- Long-run Field Price of Natural Gas
- Introduction of Combined-Cycle Technology
- Resolution of Pipeline Constraints
- Environmental Requirements

ELECTRIC UTILITY INTERFUEL COMPETITION: 1987-1988

	Non Fuel Costs	Fuel	Total
Residual:			
cents/kWh	2.03	3.15 - 3.48	5.18 - 5.51
dollars/mmBtu		(3.25 - 3.60)	
Coal:			
cents/kWh	3.12	1.31 -1.46	4.43 -4.58
dollars/mmBtu		(1.30 -1.45)	
Natural Gas Steam:			
cents/kWh	1.76	2.13 - 3.39	3.89 - 5.15
dollars/mmBtu		(2.20 - 3.50)	
Natural Gas CC:			
cents/kWh	1.21	1.85 - 2.94	3.06 - 4.15
dollars/mmBtu		(2.20 - 3.50)	

SOURCE: Charles River Associates, based on EPRI TAG, 1986 and DOE Utility Cost Data (April 1987 - March 1988).

ELECTRIC UTILITY INTERFUEL COMPETITION
REPRESENTATIVE TOTAL COSTS: 1987-1988



CLEAN COAL TECHNOLOGY

White Knight or Evolving Technology?

Fluidized Beds and Scrubber Improvements

CCT Program May Accelerate Introduction

Basic Issue: What Technology for New Plants?

- How Affected by "Deregulatory" Initiatives?
- PURPA Experience Encouraging with Respect to Coal

IMPONDERABLES

Oil and Natural Gas Prices

Combined–Cycle Technology

Utility Regulatory Decisions

Environmental Legislation

ELECTRICITY IN THE NORTHEAST

AN OVERVIEW PRESENTATION

BY

HENRY LEE

EXECUTIVE DIRECTOR OF THE ENERGY AND ENVIRONMENTAL POLICY CENTER

HARVARD UNIVERSITY

Ontario Energy Choices Conference
April 3, 1989

My job today is to take a look at future energy trends in the Northeast. Usually "the Northeast" is defined as New England and New York, but I will focus most of my remarks on the New England situation.

When I reflect back on the twenty years that I have been working in the energy field, there are several characteristics of the energy problem that continually amaze me. First, we have a tendency to always believe that the future will look, more or less, like the present. If energy demand is growing at 4 or 5%, we believe that it will continue to grow at 4 or 5%. If it is growing at 1%, we believe that it will grow out into the future at the same rate. Even those of us who think that we are somewhat visionary tend to be fairly cautious in how far we differentiate ourselves from the core of our peers in this field. Yet, repeatedly we find that we have underestimated the magnitude of future changes.

Secondly, even those who do believe in change, consistently underestimate how quickly those changes can occur. Energy markets can go from surplus to deficit in a matter of several years. Think back to 1980. Almost everyone felt that energy prices would continue to rise. The average forecast for 1990 oil prices was $51.50 per barrel. Yet, within five years, prices were close to $15.50.

Finally, even though it is contrary to the basic law of economics, there is a resistance on the part of many people to the idea that energy demand and supply react to price. In the 70s, this mind set took the form of the "iron link" theory which stated that economic growth and energy growth were inextricably linked. You could not have one without the other. Obviously, this notion was obliterated by the facts over the next ten years. Now there is a belief that the world has embraced energy conservation and no matter how low oil and gas prices go, this conservation ethic will continue. Again, facts are beginning to belie this notion.

If you compare the fourth quarter of 1988 to that of 1987, you will see significant increases in demand for oil in the U.S., Asia and Europe. With this increased demand, it will not take long to eat up the present surplus. I raise these issues because any attempt to predict future trends in the Northeastern United States is dependent on what happens to oil prices. While the region has made substantial progress in reducing its dependence on oil, it still is approximately 50% more dependent than other regions of the United States.

Having tried to hammer home the point that there is enormous uncertainty, let me give you a few thoughts on what I think will occur in terms of electricity demand in the Northeast. In the short term, the region faces severe capacity constraints. We were extremely fortunate this winter in that both January and February were unusually warm. But I am not so sure that we will be as lucky this coming summer or in the winter of 89-90. For the first time in 25 years, we face the real prospect of significant brown-outs and perhaps even blackouts.

The electricity demand in the region has been growing at between 3 1/2 to 5% per annum for the past six years. At the same time, our utility industry, with the support of state officials has been predicting growth at 1 1/2-2%. When you are off in your predictions by a factor of between 2 and 3 each and every year, you begin to quickly turn a surplus into a deficit. At the same time, our decision makers have been paralyzed by the ongoing controversy over the Seabrook nuclear station. As long as there is a prospect of Seabrook coming on-stream, utilities who own shares in the plant have been understandably reluctant to make investments which may be judged too redundant when and if Seabrook opens.

In the past eight months, the region's utilities have been making enormous strides in trying to level their maintenance schedules and to find sources of back-up emergency power. Even with these efforts, I think that the region will be very fortunate to get through the next twelve months without significant problems. It will be at the mercy of the weather and the performance of its older oil-fired plants.

There are a number of new supply options coming on-stream. Some of the cogeneration projects which are just now beginning construction are due to come on-line in the summer of 90 and more will be available by the spring of 91. In addition, Hydro Quebec II will provide New England with a much-needed influx of power from Canada. Two more years could also provide us with the time to bring significant amounts of conservation energy on line.

I do not claim that these events will eliminate the capacity problem, but they will give the region some breathing room. In the period '93 on, there are a number of supply and demand options available. The question is, " which of them will the region choose" and "is the region prepared to make the difficult decisions to go forward with those options?"

At the moment, utility planners in New England are actively pursuing 3 alternatives: 1) Energy conservation; 2) Electricity from independent power producers; and 3) Canadian imports.

Let me say a few words about each.

Conservation

There is no question that an aggressive energy efficiency program, especially in the area of new commercial building, could pay large dividends. On the other hand, conservation will not be an easy sell in a period of declining electricity prices. We will have to build a new industry, ie energy service companies, and this will take time. People will have to be recruited and trained and inevitably, there will be start-up problems.

On the other hand, it is clear that there is a strong political mandate for the utilities to aggressively pursue demand management options. To be frank, I do not think that a utility company could get government approval for new supply options without having first demonstrated that they had aggressively pursued all realistic conservation options.

Can the region get by with just conservation? Unless energy demand falls below 1% growth per annum, I see no way that this would be possible in the short to mid-term. I realize that there is enormous technological potential, but technology in and of itself is not going to reduce demand. People have to buy the technologies and install them, and therefore, I suspect that the region will be fortunate if it can meet one half of its incremental electricity demand through demand side investments over the next 12 years. This is not an insignificant amount of power, but it does not eliminate the need for additional sources of power.

IPPs

Most of the New England states have either adopted, or are in the process of adopting QF or independent power bidding schemes. Under these schemes, utility companies must seek bids for the purchase of additional power supplies. In other words, there is a strong commitment among most New England states to establish a competitive market for electric generation.

While these changes may eventually provide the region with lower cost power and a more economic mix of options, in the short term, there are a lot of problems which will have to be ironed out. Let me quickly touch on several.

Once a participant in the bidding scheme bids a price, he or she has fixed his revenue scheme. There is no ability to pass on additional costs to the consumer. It takes approximately 2 1/2 years to get through the environmental permitting process. Further, environmental standards are constantly changing and these changes result in increases in the cost of the plant--increases which under an auction process cannot be passed on. The end result is that IPPs and QFs consistently find that their margins become squeezed and projects that start out being very attractive become less so. As a result, many of the companies who submit winning bids never end up constructing their facilities. If you add to this problem the reality that it takes approximately $10-15,000,000 in up-front money to get a large QF or IPP project off the ground, one begins to see major barriers of entry into this industry.

Finally, there is the general tendency among IPPs to thinly capitalize and accept higher operating costs. This reality is not only true for the developer, but is also valid for the state regulator seeking to implement a least-cost energy plan. Natural gas is presently the "least cost" fuel of choice. Yet, ten years from now "least-cost" may be defined as coal or some other fuel.

If history is the judge, when we embrace one fuel or energy source as the answer, events tend to prove us wrong. It usually is a better option to have invested in a portfolio of options.

I suspect that many of the problems with IPPs will be ironed out over the next 4-5 years, but again I feel that there will be a lot of start-up problems.

Canadian Power

I have been very bullish on Canadian power for many years. I feel confident that many of the problems that are raised by others, such as reliability and price can be resolved. On the other hand, I think there are two major obstacles to expanded Canadian imports through the Northeast.

The first and I believe, probably the most difficult, would be the siting of additional transmission lines. As we become a more congested region, it will become increasingly difficult to get local approvals to lay major new transmission facilities throughout the Northeast corridors. This is not only true in New England, but it is also true in New York.

If you look at the estimate of Canadian export potential in the recent U.S. Department of Energy report, 5-10 major transmission lines will be needed if the Northeast is to realize the potential for power purchases from Canada. I am skeptical that this will occur without significant changes in transmission technology.

Further, if we go to a system of relying almost exclusively on cogenerators and Independent Power Producers for our power, the issue of transmission access will become a major point of controversy. Canadian power will have a big stake in this debate. How regulators price transmission and how they allocate capacity on the system will determine the economic viability of any third party sale of power.

Further, recent generation capacity problems in the Northeast have made that region an obvious market for power sales from Quebec. In the years ahead, however, there will be other markets. Ontario certainly will be one. But I suspect that U.S. sources beyond New England will take a closer look at Canadian power. The bottom line is that there will be more competition for Quebec power which will push the price up. Hydro-Quebec power will end up being sold to where it is most valued.

There is one final factor affecting electricity in the Northeast, which I should mention. The drought of last summer, combined with the concern about hazardous waste and the ozone hole in the stratosphere, has recatalyzed public concern about environmental issues. Our politicians are now tripping over each other to be perceived as tougher on cleaning up the environment than their colleagues. Invariably, standards will be tightened (i.e. an acid rain bill will pass), restrictions will be more numerous and the end result will be higher prices and less flexibility. Siting, which is already difficult, will become more so.

Electricity prices will reflect this increase in environmental protection, proving greater incentives for conservation and purchases of power from outside the region.

In summary, New England faces a future characterized by many uncertainties. My guess is that we will do what we always have managed to do--muddle through, but "muddling"will carry with it a cost, which will be manifested in the form of higher prices and greater competition for Canadian power and energy efficiency technologies. How high the price and how aggressive the competition will depend on whether oil prices increase rapidly in the 90s and whether the Northeast economy continues to grow. High prices and slower economic growth will dampen demand and lessen the urgency to pursue other options. If prices continue to be low and economic growth continues at the levels experienced recently, then demand will increase rapidly and the utilities will have difficulty in filling their needs. In the latter instance, New England utilities will likely compete with Ontario's for power purchases.

HOW ONTARIO'S ENERGY CHOICES HAVE BEEN AFFECTED BY THE NATIONAL ENERGY BOARD

Presented by

J.-G. Fredette
Vice-Chairman
National Energy Board
Ottawa, Ontario

ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3, 1989

Highlights

	Page
NEB Mandate - The Board provides energy advice and regulates construction and operation of pipelines and international power lines; traffic, tolls and tariffs of pipelines; exports of oil, natural gas and electricity; and imports of natural gas.	3
Oil Trade - Oil trade is essentially free between Canada and the U.S. since 1985. Canadian exports have increased more rapidly than imports, resulting in growing net exports. Oil products imports into southern Ontario have more than doubled, affording consumers the low prices produced by competitive markets.	4
Canadian Gas Export Policy - Major steps have been taken since 1984 to deregulate prices and volumes.	6

Market-Based Procedure for Gas Export Regulation - This procedure, which replaced volumetric surplus tests, is aimed at ensuring fair market access, no disruption of Canadian energy markets, and that the export proposal is in the Canadian public interest. The possibility for the Board to intervene is retained if markets are not working smoothly and fairly. 7

TransCanada Gas Pipeline - The Board opened access for all shipments under fair and equitable conditions, and assisted a smooth transition to market-sensitive pricing. 9

Short-Term Firm Transportation Service - As a result of pipeline access and deregulated prices, choices increased and direct sales burgeoned. 11

Gas Pipeline Facilities - The Board approved competing pipeline facilities to promote competition in Ontario gas supplies. 12

Regulation of Electricity Exports - Results of a Board inquiry into reducing regulatory overlaps and the regulatory burden formed the basis for federal/provincial consultations. 14

New Electricity Export Policy - Under the new policy, Board regulation will concentrate on aspects not dealt with by the provinces. It will continue to ensure fair market access at prices no higher than for exports. 15

Interprovincial Trade in Electricity - The Board will identify and examine measures to permit trade to grow, cooperation to increase, and access across intervening provinces. 16

Conclusion - The result has been widened choices with fair and equitable access to supplies and markets. 17

The basic point that I want to make today is that the energy market place has changed considerably in the past few years and that consumers and suppliers in all of Canada and in Ontario specifically have a wider array of choices as to where supplies are sourced and surpluses disposed of.

For each of oil, natural gas and electricity we will examine what is new in the North American market-place, the role played by the National Energy Board and the implications for Ontario.

The Mandate and Actions of the National Energy Board

Let me first remind you of our Board's mandate.

Slide 1 — Mandate of National Energy Board

Function	Examples
Advisory	*Energy Supply/Demand Outlooks* *Natural Gas Market Assessment*
Regulate construction and operation of pipelines and power lines	*The next TransCanada expansion hearing starts April 12*
Regulate traffic, tolls and tariffs of pipelines	*January 1989 decision on "self-displacement"*
Regulate exports of oil, natural gas and electricity, and imports of natural gas.	*Mackenzie Delta gas export hearing starts April 10*

The Board grants certificates to construct and operate interprovincial and international oil, gas, and petroleum products pipelines, as well as international power lines. It has regard to, inter alia, the need for the facilities, the adequacy of supplies, public safety, environmental protection and socio-economic impact considerations.

The Board regulates the traffic, tolls and tariffs of pipelines under its jurisdiction to ensure that the tolls are just and reasonable and that there is no unjust discrimination in tariffs or service.

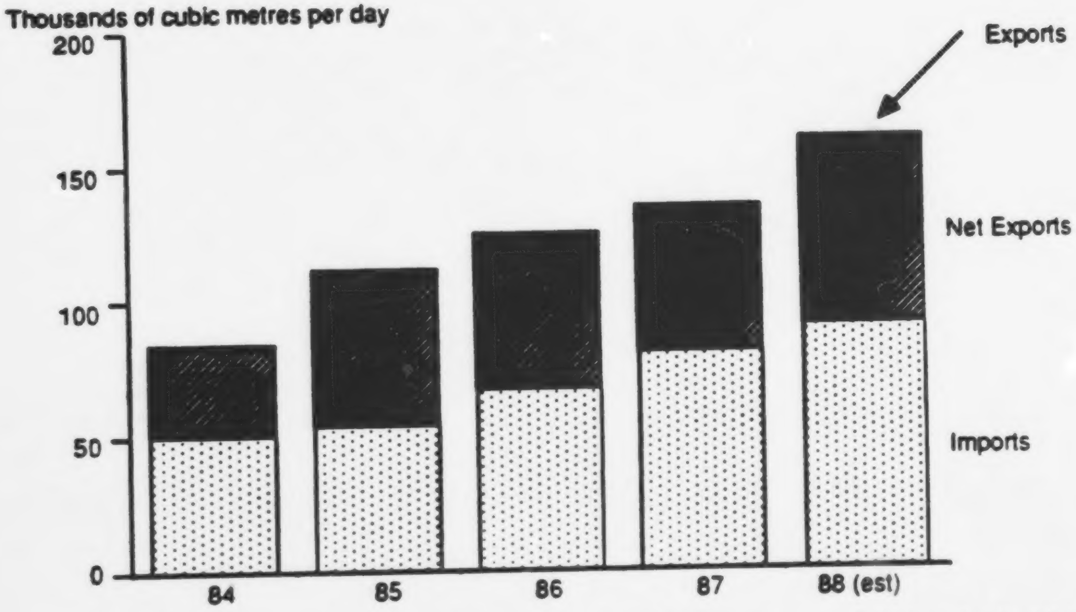
After holding public hearings, the Board issues long-term licences for the export of oil, natural gas and electricity if it finds these to be in the public interest. It also authorizes short-term exports by order without public hearings, and issues licences and orders for natural gas imports.

The Board's licences and certificates, but not its orders or other decisions, are subject to the approval of the Governor in Council.

The Board has no regulatory activity in respect of coal or nuclear energy.

Now, a brief look at oil trade.

Slide 2 — Trade in Oil & Oil Products



Both Canada and the United States have eliminated the oil price and volume controls of the '70s and early '80s. In Canada, the 1985 Western Accord ended the system of administered oil prices which had been in effect since 1973. It also replaced licensing of almost all crude oil and product exports by a monitoring system. Trade could then proceed on a purely market basis. Our crude oil and products exports, primarily from Western Canada, have increased in each of the last four years, and in 1988 stood 88 percent above the level in 1984. Our oil imports, primarily to Quebec and Eastern Canada, have also increased, but more slowly. As a result, our net exports of some 68 000 cubic metres per day of oil and oil products in 1988 were double what they were in 1984.

The direct effect of this has been that Ontario now pays world oil prices and those prices happen to be not much more than half the level they were at deregulation. The province of course continues to rely for its supplies of oil mainly on Western Canada. Ontario's refiners have had no difficulty in competing successfully against American buyers for her needed crude oil supplies. A choice of imported crude oil, whether from the United States or overseas, is technically available, but so far Canadian crude oil has proven more than adequate in terms of supply and competitive in regard to price. Oil remains the largest single source of Ontario energy, accounting for 38% of provincial end use energy demand in 1988.

Since 1984, the two-way trade of petroleum product exports and imports into Southern Ontario has changed significantly. Exports have decreased by almost 40 percent while imports have more than doubled(1). This trade, mainly in gasoline and middle distillate, has made Southern Ontario's wholesale and retail market the most competitive in Canada. This is a reflection of the relatively large number of independent oil companies and refineries located here and the proximity of both competitive supply from and alternate markets in the Buffalo area. The availability of imports and the access to export markets reflects the choice which is available to oil products refiners, resellers and consumers. As a resident of Ottawa, I envy gasoline consumers in Southern Ontario who during 1988 paid anywhere from 3 to 8 cents a litre below Ottawa prices.

In 1985 and 1986 the Board approved expansions of the Interprovincial pipeline to ensure sufficient pipeline capacity.

The Board has also set tolls that are just and reasonable and established procedures which permit shippers to access pipeline space on an equitable basis.

An integral part of the Board's monitoring function related to oil trade is the provision of monthly and annual volume and price information for the use of the federal and provincial governments and industry participants.

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1. Petroleum product exports from Ontario decreased 38 percent, from 1,545,000 cu.m. in 1984 to 953,000 cu.m. in 1988; imports increased 117 percent, from 185,000 cu.m. in 1984 to 402,000 cu.m. in 1988.

Canadian gas export policy has long attracted Ontario's interest in relation to both volume and price aspects. The past five years have seen dramatic changes in regulation.

Slide 3 — Canadian Gas Export Policy

• Nov. 1984	Competitive export pricing replaced administered pricing
• Nov. 1985	Deregulation of short-term (less than 2 years) sales
• Nov. 1986	— Canadian domestic price deregulation — Export price monitoring
• July 1987	Market-Based Gas Export Procedure replaced volumetric tests

Major steps have been taken over the past few years to deregulate prices and volumes. After a decade of regulation, export prices are now set by buyer/seller negotiation. Short-term exports now proceed with no volume constraints under Board orders which permit the monitoring of prices and volumes. Longer-term exports must still be licensed requiring public hearings, but volumetric surplus tests have been replaced by a Market-Based Procedure which is consistent with the move to market-sensitive pricing begun with the October 1985 Agreement on Natural Gas Markets and Prices. Producers are now free to choose their levels of sales and inventories, and to negotiate prices.

Slide 4 — Market-Based Procedure for Gas Export Regulation

Goals	*Procedures*
Fair market access	*Complaints procedure (onus on buyer)*
No disruption of Canadian energy markets	*Export Impact Assessment (onus on export-applicant)*
National public interest	*– Benefits to Canada – Substantive commercial arrangements*

To ensure that Canadians have fair market access to Canadian gas on similar terms and conditions, including price, as do export customers, the Market-Based Procedure includes a complaints mechanism whereby Canadian gas buyers who feel they have not had fair access can make their case at Board hearings.

To determine whether a proposed export is likely to cause Canadians difficulty in meeting their energy requirements at fair market prices, the applicant must submit an assessment of the impact of its proposal on Canadian energy and natural gas markets.

To ensure the proposal is in the national public interest, the Board examines all other relevant factors, including all costs and benefits, the supply and market characteristics, and the quality of gas purchase, sales and transportation arrangements.

I want to repeat that the Board does not regulate gas prices, either domestic or export. These are set in the market-place.

The basic premise of the Market-Based Procedure is that market forces will generally work to assure Canadian gas requirements, albeit at a price sufficient to balance Canadian supply against the sum total of domestic demand and export requirements. At the same time, the possibility for the Board to intervene is retained if markets are not working smoothly and fairly.

The Market-Based Procedure provides a framework within which Canadian buyers can achieve security of supply by contractual means. It is consistent with the Free Trade Agreement which has reinforced the actions taken by both Canada and the U.S. over the past few years to put energy markets on a competitive basis, with fair market access and a level playing field.

It is important to recognize that changes in both oil and gas export policy were necessary in order that Canadian consumers - many of them in Ontario - be given broader choices at market prices. The export component was needed because part of the bargain was that Canadian producers too should have greater choice of market than had previously been available.

Pipeline tolls and access have become a major preoccupation of the Board in relation to gas market deregulation.

Slide 5 — TransCanada Gas Pipeline Traffic, Tolls and Tariffs

1986:
- — Access mandated using NEB Act powers
- — Operating Demand Volume concept introduced to eliminate double demand charges
- — Distributor self-displacement prohibited
- — Sharing of TOPGAS charges recommended

1987:
- — Operating Demand Volume concept refined and implemented
- — Distributor self-displacement prohibition confirmed

Until 1985, gas pipelines were merchants as well as transporters of gas, and TransCanada carried almost only its own gas.

The essence of the Board's work over the past few years has been to open the access to TransCanada and other gas pipelines, and to establish fair and equitable conditions of access for all those wishing to ship gas, be they producers, distribution companies, marketers or end users.

Initially, in 1986 and 1987, the Board assisted the smooth transition to the new market-sensitive pricing environment. On the one hand, the Board ordered TransCanada to carry others' gas, introduced the Operating Demand Volume concept to eliminate the duplication of demand charges, and proposed the sharing of the carrying costs of take-or-pay charges. This allowed choices to be made between systems gas and direct purchases. On the other hand, the Board initially restricted distributors from displacing system gas purchased under contract from TransCanada with gas purchased directly from producers.

Slide 6 — (Continuation of slide 5)

1988:
- Firm service contracts of any duration greater than 1 year allowed
- Renewal rights on firm service contracts
- Bumping of short-term shippers eliminated
- Procedure for queuing introduced

1989:
- Distributor self-displacement prohibition removed.

Last year, the Board established tolls for new categories of firm and interruptible service, and established tariff conditions which assured pipeline access on a continuing basis.

This year the Board has announced that the prohibition on distributor self-displacement will be ending effective 31 October 1989. This will facilitate the continued fair and orderly transition to a competitive, market-sensitive pricing regime. It will increase the choices available to distributors.

Issues in respect of access which are still before the Board include details of queuing procedures and capacity brokering.

Slide 7 — Short-Term Firm Transportation Service on TransCanada

	Dec. 31 1985	Dec. 31 1986	Dec. 31 1987	May 13 1988
No. of Contracts	0	24	214	354
Volumes (PJ/year)	0	70	210	240

(Source: Natural Gas Market Assessment)

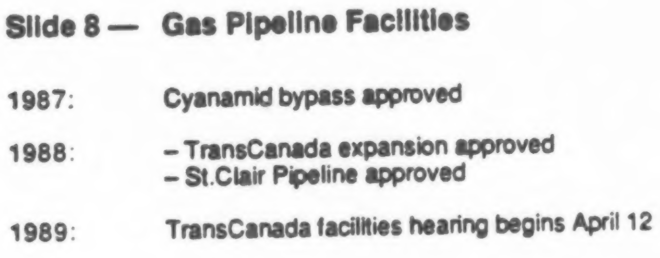
The results of the Board's opening-up of interprovincial gas transmission, together with gas price deregulation, have been dramatic.

Non-residential gas buyers have the option of purchasing sales service from their local distribution company (LDC), buying system gas under a resale arrangement with Western Gas Marketing Limited and the LDC, or arranging a direct purchase of gas from Alberta or from Saskatchewan, a new market entrant, to be transported to the user via TransCanada and the LDC. This proliferation of arrangements is reflected in the growth of short-term firm transportation service from zero to hundreds of contracts for the shipment of direct sales. In most cases the shipper was a distributor.

The significance of this is, of course, that competitive gas prices are now set by market forces in a market with many buyers and many sellers.

One of the choices available is imported gas. Although Ontario used no imported gas in the first half of the 1980s, small quantities were imported in 1986 and 1987, and by 1988 imports satisfied some 3 percent of the Ontario gas market.

Gas market growth in Ontario and the dictates of competition have led to the Board's approval of new pipeline facilities.



Slide 8 — Gas Pipeline Facilities

1987:	Cyanamid bypass approved
1988:	– TransCanada expansion approved – St.Clair Pipeline approved
1989:	TransCanada facilities hearing begins April 12

In addition to approving in 1988 TranCanada expansion for domestic and export requirements, the Board was faced with fundamental questions concerning federal/provincial jurisdiction and competition. I will give you just two examples of Board decisions which have promoted competition in Ontario gas supplies.

First, in 1987, the Board approved a pipeline extending from the TransCanada system to a Cyanamid ammonia plant in Welland, bypassing the facilities of Consumers' Gas. The Board felt these facilities would serve the public interest in that they would allow the proper signals to flow to the market and particularly to Consumers' Gas, whose rates to Cyanamid were above the costs of the service provided.

Secondly, in 1988 the Board approved an application from St. Clair Pipelines to construct a pipeline connecting gas distribution and storage facilities in Michigan with the Union Gas system. This will permit the exchange of gas under emergency or other conditions, and can serve as a new gas export or import point. At the same time, the Board denied an application from

TransCanada for alternative facilities. The Board's decision was based on encouraging greater competition, by increasing the choices available in the market-place to Canadian consumers between Canadian and American sources. The St. Clair facilities will enhance the supply diversity of eastern Canadian gas users and provide greater flexibility in negotiations.

In both its tolls and gas facilities decisions, the Board has sought to enhance the degree of competition in the market-place.

By the way, I expect everyone here is aware of the handbook: A Guide for Ontario Natural Gas Buyers, recently published by the Ontario Ministry of Energy. This very useful guide is complete with information on the natural gas choices available and on how to exercise those choices.

Electricity, to which we will now turn, satisfied 18 percent of Ontario's end use energy demand in 1988.

Slide 9 — Regulation of Electricity Exports

1986/1987:	Board Inquiry into the Regulation of Electricity Exports
1988:	New Electricity Export Policy
1988/1989:	Implementation of New Policy

Electricity exports are another area in which there has been a lot of activity over the past few years.

In 1986, at the request of the Minister of Energy, Mines and Resources, the Board held a wide-ranging inquiry into electricity export regulation which resulted in a new export policy.

The focus of the Board's inquiry was how to eliminate any overlap of federal and provincial regulation of electricity exports and facilities and what changes would be appropriate to the Board's procedures in order to reduce the regulatory burden.

The report in mid-1987 of the Board's inquiry was used as the basis for federal/provincial consultations.

Slide 10 — New Electricity Export Policy

Goals:
- streamline regulation and reduce duplication
- federal regulation to concentrate primarily on those aspects of a proposal that may not have been sufficiently dealt with by provincial practices
- federal oversight to ensure that provincial approval processes are adequate and accord with federal environmental standards

Under the new policy announced in September 1988, the Board's regulation will concentrate primarily on those aspects of a proposal which are clearly of Federal jurisdiction, such as extra-provincial environmental, technical, or other impacts. For example, the Board will consider whether the reliability of interprovincial electricity flows would be affected by new exports. As well, it will continue to ensure that Canadians have fair market access to electricity proposed to be exported, at prices no higher than those offered to export customers.

The Board has implemented the new policy to the extent feasible under current legislation pending the introduction of changes to the Board's Act and Regulations.

When fully implemented, the Board will be able to authorize electricity exports and new international power lines without a public hearing.

Slide 11 — Interprovincial Trade in Electricity

Goals:

Identify and examine measures to:
- permit interprovincial trade to grow
- encourage utilities' cooperation in joint planning of developments
- enable electricity wheeling

In September 1988, the Minister of Energy, Mines and Resources asked the Board to identify and examine possible measures to enhance interprovincial trade in electricity, to encourage greater cooperation between utilities, and to enable buyers and sellers of electricity to obtain commercial access to available transmission capacity through intervening provinces.

The Board is considering how best to respond to the Minister's request and we hope to be able to announce shortly the procedure we will be following.

I can say that the Board is thinking about a phased approach in which it would seek first to assemble the facts related to the potential benefits from enhanced interprovincial cooperation and trade and from the transmission of electricity from one province to another through a third province. The Board would also hope to address technical problems experienced with wheeling of electricity in North America and Europe.

Slide 12 — Conclusion

- Major changes in NEB regulatory activity over last 5 years.
- Board actions instrumental to opening access to pipelines and export markets.
- Board actions complemented others' actions.
- Result: widened choices with fair and equitable access to supplies and markets.

Conclusion

The picture I have tried to present is one of major change in many areas of the National Energy Board's regulatory activity, occurring in the short space of five years or less. The Board has acted against the broader background of fundamental changes in national energy policy - changes which have generally been approved - explicitly or implicitly - by the provinces, including Ontario. The Board's actions were to a large degree instrumental in achieving the new market orientation of Canadian energy markets in the context of federal government defined policy: I am thinking particularly of pipeline and export-access. But they could not have been effective without concurrent actions by others - producing-province governments and regulatory authorities in all provinces. Their result has been a widening of choices and progress toward the goal of all market participants having access to energy supplies and markets in a fair, efficient and equitable manner.

RESPONSIBLE MANAGEMENT OF ENERGY

presented by

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Sarnia, Ontario

ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

Polysar is a $2 billion Canadian international petrochemical company. It is among the world's largest producers of synthetic rubber and is a major producer of plastics, basic petrochemicals and fuel products.

We buy our principal hydrocarbon feedstock requirements of crude oil and natural gas liquids in Western Canada and on the international market for shipment to our refinery in Corunna, Ontario.

There the feedstocks are "cracked" into their component streams of basic petrochemicals. These streams and residual fuels are either sold under long-term contract to other companies, or are further upgraded internally.

Petrochemicals are among the most energy-intensive products. In fact only a few non-ferrous metals "consume" more energy, as shown by the energy-content figures for the main primary products.

(Slide 1)

It should, however, be noted that if the energy content is considered from the point of view of the relative competitiveness of various materials you should look at volume as well as weight. Measured in this way the energy content of petrochemicals is not nearly as great a handicap as would appear from the slide.

(Slide 2)

For example, slide #2 shows that polyethylene and paper are virtually identical on this basis while paper has less than one third the energy content of polyethylene.

The energy products required by Polysar and the petrochemical industry are chiefly in the form of gas and oil. About two-thirds are used as feedstock for synthesizing various compounds and the remainder as the source of energy required for the various processes whether in the form of heat, steam or electricity. In petrochemical facilities such as ours these costs can amount to as much as 70% of total manufacturing expenses.

Because of the high costs of feedstock, fuel and electricity energy management and conservation normally receive intense scrutiny throughout the chemical industry.

This process began in earnest as a result of the two oil price shocks. A 1985 OECD report (Petrochemical Industry Paris, 1985) shows the overall reduction in energy consumed per chemical production unit in member countries was about 17 percent between 1973 and 1981. According to the U.S. Chemical Manufacturers Association, their industry improved its energy efficiency by 23.4 percent during the same period.

In Canada the Chemical Industry Energy Conservation Task Force set a goal of a 40% improvement in aggregated energy utilization by 1990 over 1973. This goal was achieved in 1987 - three years ahead of schedule. Most of these gains came from new plant construction, new processes and associated productivity improvements.

The OECD study found that immediately following 1973 many organizations appointed special staff to co-ordinate and oversee this energy-economy drive by impressing on everyone the importance of "housekeeping" measures in containing costs. By the adjustment of process variables, for instance in distillation processes, to minimize energy usage and more attention to leaks and heat losses, a very significant improvement in energy performance was achieved.

At Polysar today we have an energy control group whose task is to continually look for ways of reducing our energy use. This not only saves us money but helps us comply with the ever increasing regulations imposed by Governments.

(Slide 3)

Slide #3 identifies some of the more obvious actions we have taken which contribute to a $41 million annual energy saving at our main Sarnia site.

For example, we have a dedicated group of 4 pipefitters who go around and check for leaks at the 12000 traps. This activity alone saves up to $2 million per year in energy losses.

In addition to the substantial achievements made to date, this group is continuing to explore opportunities for more co-generation, process simulation and other efficiency improvements. We have been working with Ontario Hydro to determine what the theoretical limits are to the efficient use of energy at our plant, and we are confident more gains are possible.

Another line of development reported by the OECD was the redesign of petrochemical processes to reduce feedstock, fuel and energy consumption per unit of production.

One successful example of this approach is in the production of methanol. The original high pressure process was superseded by a low pressure process with a saving of 12 percent in energy used for feedstock and fuel. The process flow scheme was completely redesigned a few years later to improve thermal efficiency and a further saving of about 11 percent was achieved. After the second oil price shock the distillation section of the process was redesigned to save heat energy and a further 6 percent reduction in total energy usage was achieved.

In response to changing demands for our products and consistent with Government policy to use less oil, one of our plants in Sarnia invested $123 million in plant changes to reduce its crude oil usage from 150000 to 65000 barrels per day. Since this was completed in 1984 we have reduced that demand a further 50% by substitution and additional capital expenditures.

Apart from these feedstock improvements we have been working with the engineering company that designed our original ethylene plant with state of the art technology and we have seen dramatic gains in energy consumption per unit of ethylene output.

(Slide 4)

Much of the drive to improve fuel and feedstock consumption in petrochemical plants can be traced to economic events such as the oil price shocks of the 1970's. But more and more that drive is only part of the stimulus. The emergence of environmental awareness and regulation is clearly having an impact on business decision making.

More than twenty years ago we switched from coal to natural gas at our power house because we were faced with reducing the particulate matter in the air and it made more sense to switch to the cleaner burning natural gas. In fact, most of the decisions involving water quality and atmospheric discharges at our plant have been made by considering both the economics and the environment.

Polysar and most chemical producers in Canada belong to the Canadian Chemical Producers' Association. As a condition of membership the CEO must sign a formal agreement indicating his commitment to the "Responsible Care" program.

Several years ago the Association recognized that in order to have any credibility and, hence, influence, particularly in matters relating to the development of legislation and regulation - it was necessary to position itself as a key industry economically and one which acted responsibly in the management of its products and processes.

One of the principles set out in this policy applies directly to my remarks:

> "make responsible care an early and integral part of the planning process leading to new products, processes or plants"

At Polysar we have taken this responsbility seriously, and have incorporated this kind of thinking in our internal policies and decision making. For example, we have a position on environmental issues which has been circulated to governments and others which states :

(Slide 5)

> The Company will routinely incorporate an assessment of health and environmental impacts as a significant factor (along with the more traditional economic variables) in the decision making process.

I can assure you when we are preparing the necessary background information to support a request for board approval on any project today we require this input and signature of the responsible officer before the proposal is presented.

Although Polysar has 14 plants in North America and Europe, the vast majority of our assets are in Ontario. We sell our products around the globe and to do that we must be internationally competitive. Government set energy policy and environmental regulations are of prime importance in determining how competitive we will be. As such we take an active role in working with the policy makers to arrive at the proper balance of environmental, economic and social goals in the planning, development and use of energy and the environment.

Bob Dudley, who recently retired as the CEO of Polysar Limited, felt that among the most important public policy initiatives he participated in was the recent Energy Options exercise chaired by Tom Kierans. He didn't need the extra work, but he believed it was critical that industry work side by side with other stakeholders to advise Governments on the path to follow.

He often expressed frustration at those who wanted all energy development in Canada to stop. After all, he was running a company whose very survival is tied to energy use.

Out of his frustrations and that of many others on the task force came a realization that:

> "to achieve efficient allocation of energy resources market mechanisms should be relied upon wherever possible and enhanced where necessary"

in addition they observed:

> "that Governments have an increased responsibility to ensure that markets are neutral, balanced and operating effectively. Where they are not, governments should improve the workings of the market."

These conclusions are consistent with those of the Brundtland Commission and others who believe it is possible to promote environmentally sound economic growth and development as long as they are not pursued in isolation.

Unfortunately, the strong linkage between environment and economy is not adequately reflected in the structure of our governments or our corporations.

In business we need to develop different analytical methodologies for project assessment because traditional DCF return on investment techniques don't work well in relation to the value of the environment. And yet these techniques are a fact of business life. We compete for investment capital and unless we provide satisfactory returns we don't get it.

In Government there needs to be a better linkage between the economic and environment departments within and between governments to avoid the compounded burden of regulation. For example, independent ministries in Ontario can impose a variety of regulations on Ontario based companies without any overall assessment of how this affects the business. The Federal and local governments compound the problem. The challenge for government is to look at the total picture and measure the overall cost against the overall benefit of their actions.

This conference is addressing Ontario's energy choices. We all know this is not a simple discrete selection which having been made will serve all of Ontario's interests for years to come.

With free trade a reality between Canada and the U.S. and the increasing globalization of the world economy it is difficult to imagine how a government today could set Canadian oil and gas prices below the world market price. Similarly it is difficult to imagine how a company like Polysar would be able to export from Ontario if it was an inefficient user of energy or its energy choices were limited by Government policy.

We believe in working with Governments to our mutual advantage, and we plan to continue working with the Ontario Government as its energy policy unfolds.

Thank you.

Energy Content (GJ per tonne)

Primary aluminum	184
Copper	130
Polystyrene	105
Polypropylene	97
Polyethylene	87
Styrene	77
Ethylene	63
Propylene	61
Methanol	37
Lead	30
Paper	25
Steel	20
Glass	20
Cement	7

Source: BASF; ICI; Battelle Columbus Laboratories

Energy Content Of Some End Products

	Tonnes oil equivalent
1 million fertilizer bags	
polyethylene	360
paper	350
100 km of pipe	
polyethylene	90
copper	96
galvanized steel	500
1 million litre bottles	
polyester	150-175
PVC	100
glass	230-600
Car hood	
steel	7.3
aluminum	13.6
fibreglass reinforced plastic	6.6

Source: The British Plastics Foundation

Actions Taken Affecting Energy Use

- Altering Product Mix
- Flare Gas Recovery
- Hot Water Recovery
- Heat Recovery
- New Boiler
- Computer Controls
- Fuel Conversion
- Burning of Byproduct Streams

Source: Polysar's Energy Control Group

Specific Energy Consumption

	BTU/lb Ethylene
Petrosar plant	16000
New plant	
propane	7235
ethane/propane	6850
ethane/butane	6705
propane/butane	6955

Source: Lummus Canada

The company will routinely incorporate an assessment of health and environmental impacts as a significant factor (along with the more traditional economic variables) in the decision making process.

Source: Position on Environmental Issues
Polysar Limited

ENERGY AND THE ENVIRONMENT*

Presented by

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University of Toronto
Toronto, Ontario

ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

* This paper was transcribed directly, with very few editorial changes, from the tape of Dr. Hare's remarks. Some comments have been deleted because they referred directly to slides which are not included in this paper.

Scientists are saying that the polar ice cap will expand, it will engulf in a new ice age. So when do we inherit the earth? say the penguins. That was the wisdom ten years ago, it was in the United Church Observer would you believe, and here we are talking about a world which has a runaway greenhouse and becomes uninhabitable because of human intervention. I want to ask the questions: is the greenhouse effect real? is there observation that confirms it? what about the ozone effect? do the observations suggest that these are simply the imaginings of prophets or that they are already evidenced?

The upward trend of carbon dioxide is, I suppose, well known to you. The present amount in the atmosphere is close to 750 billion tonnes and is increasing at about three billion tonnes per annum. The latter is part of the 5.4 billion tonnes being released annually; the rest I hope is going into the ocean, though it is very difficult to persuade the ocean scientist that that is feasible. If you look at it world scale, it doesn't make any difference where you do the observations because apart from the annual bouncing up and down which is caused by the seasons, the rise is remorseless. There has not been any very obvious response to the reduction of carbon use that was supposed to have taken place for a short time in the last decade. It has gone on going up. The evidence is that carbon dioxide in the atmosphere has continued to increase worldwide and shows no signs of being retarded by any actions, such as sanctions, that might have been taken to date.

But carbon dioxide is not the only villain, and I thought I would like to point this out in the presence of so many energy people. About half the problem comes from other sources, for example, from the synthetic chemicals, the chlorofluorocarbons which are amazingly effective in spite of their low concentrations in the atmosphere, from nitrous oxide coming off agricultural land in all probability, from methane also probably coming off agricultural land, and from a very large host of other substances including ozone and perhaps water vapor. Carbon dioxide is only half the problem; the other half is the other greenhouse gases. And I have the honor to be the Chairman of the United Nations Advisory Group on Greenhouse Gases. Look at methane for example. Methane which might come off rice patties, might come off our muskegs, might be escaping natural gas, might be a whole variety of things, is not adequately understood. In the beginning of the industrial revolution a concentration of methane that had stayed there, close to seven hundred parts per billion by volume, suddenly turned upwards, and the rate of increase now exceeds one percent per annum, which for a global average is a most remarkable figure, exceeded in fact only by the human population.

There is perfectly good, hard evidence that the greenhouse gases are building up in the atmosphere and that they are building up at a remarkably high rate given that these are global totals we are talking about. The synthetic greenhouse gases are: the freons, as the DuPont company would call them, the chlorofluorocarbons as it is fairer to call them because they're not only produced by DuPont; methal chloroform, another synthetic; carbon tetrachloride, a cleaning fluid and highly toxic, which incidentally is slowing down a bit, and nitrous oxide.

Let me then ask the question, has the temperature increase been observed? This is world global mean temperature as averaged something over 40 million observations of air surface temperature, after allowance has been made for the effect of urbanization, after the balance has been struck between land and water, after adequate allowance has been made for the thinness of observation in the polar regions. The temperature has risen .7 degrees Celsius since 1860, or about half a degree in the last century. The temperature increase appears somewhat to have halted in the three decades beginning 1940, but has resumed to such an extent that the 1980s are by far the warmest decade in the history of recorded observations, and 1988 has turned out to be marginally the warmest of the whole bang. The increase in temperature is not a linear increase, not a smooth one, mostly because of the northern hemisphere. The rate of rise is approximately near the lower limit of what you would expect theoretically from the observed increase in the greenhouse gases. In other words, observation confirms that the warming is in progress, but it is about as slow as the most conservative forecasters would have predicted. Which is good news, but at the same time a bit disconcerting because one would have preferred the thing to have been in the middle of the distribution, and it turned out not to be.

Let me take the ozone balance. I was working on ozone thirty years ago. It was then a big issue as it is today, and in those days we thought the behavior was dynamical. Today, we tend to say that this is also the result of human interference in the chemistry of the atmosphere. The overall reduction of year round ozone worldwide is still comparatively small, in the order of two or three percent. There is a great deal of uncertainty about it because we are now only in the early stages of getting complete control over the satellites which make these observations. It would appear that the downward trend of ozone in the atmosphere is more or less on schedule from the theoretical predictions made many years ago by my good friend Sherry Rowland who not only was the inventor of the ozone effect, the attack of the chlorine compounds on the ozone effect, but also the man who first spotted the fact that the extra mercury in the swordfish was just as true of museum specimens as of modern specimens. It turns out that the swordfish is a natural concentrator of mercury.

What about the second stage? What about our mathematical models? Our mathematical models of the atmosphere are pretty fearsome creatures and they differ widely among themselves. The results of the model of Jim Hansen of the Goddard Institute for Space Science more or less fit the observations so far that the observed rise of temperature in the atmosphere is more or less on target. I may say that the 1988 mean annual temperature comes close to being in the same belt as the warmest temperature of post-glacial times around about six to nine thousand years ago. So, we are indeed heading into the unknown at the present time. Temperatures are beginning to climb towards absolutely unexperienced levels in the world. You cannot say, however, categorically that the greenhouse effect has been proved out by these observations. They are consistent with the greenhouse effect; they are not proof that the greenhouse effect is real. What is needed is a few more years of observation and a damn sight better set of models, and we are looking towards that.

In closing let me ask the question, what does this imply for the world that we occupy? The biggest questions and the most irresolvable questions are how humanity will cope with these changes. I have economist friends who say absolutely no problem, the changes are slow, the market will cope, we have plenty of illustrations where larger changes have been absorbed by the macroeconomic systems of the world. That's one side. There are others who say if we don't take action now, centrally, by international convention we are digging our grandchildren's graves. That's the other end of the spectrum of opinion about the consequences. But look at this map to give you some idea of the potential consequences for Canada in very unemotional terms. The yellow in the middle of North America is the present extent of grassland climate, supporting the grassy surfaces of the world, supporting the wheat fields and so on. The one below is where those same climates will be after a doubled greenhouse effect, which is conceivable by the year 2030 to 2040. The whole of Canada's boreal forest would in fact be out of kilter with its environment, and that of western Canada and would find itself growing in a climate which today is adapted to grasslands. It is this imbalance of the world's ecosystems that is the largest unknown and one where most action is required.

May I finish with this thought by another good friend Joe Smagorinsky, the long time head of the modelling center at Princeton, who has done most of the early work in this area. Smagorinsky said something like this. Okay, we burn the fossil fuels, we produce carbon dioxide, it interacts with the trees and so on because it's a good fertilizer, but some escapes into the atmosphere and stays there, about three billion tonnes a year. That produces a climatic change which impacts crops and animals, and therefore produces a tangible dollar response in the human species, impact on humanity through the pocketbook is the surest way, he says. But he then went on and said that human beings are not stupid and if they are hit in the pocketbook, they immediately react by considering their options. Why not change land use practices? for example. Grow winter wheat instead of spring wheat, that sort of thing. Why not alter the management of water? Why not build dams that are somewhat larger with more storage capacity? Why not tap more ground water? Why not do something with the present stream flow? Why not alter the utilization of the oceans? Why not take out more fish from some regions and less from others, or something of that sort? And finally, why not change the pattern of energy use in such a way as to minimize the output of carbon dioxide? At the time when Joe said this, we hadn't really realized the extent to which other than energy alternatives also affect the build up of the greenhouse effect.

Finally then, if you do take a decision towards minimizing the output, as we did in the Toronto conference last summer with the recommendation for a twenty percent reduction by the year 2005 in carbon dioxide output with an accelerated slowdown of the production of chlorofluorocarbons, then we go back to the beginning of the cycle and slow it down. That is about as far as the imagination of me and my scientific colleagues can go. What we urgently need is the serious assistance of economists who will take this idea seriously. So far the level of debate in the question of what the response ought to be either by the individual firm and corporation or by the state has been conducted at a level of extreme naivety. The economists don't really know what the meteorologists are talking about, and the meteorologists don't know the first damn thing about economics. And so, accordingly, it has tended to be a dialogue of the death. But for God's sake, you're engineers. An engineer is a scientist who has decided to make money, I know that, there's a big difference. And I hope, therefore, that you will take your subject much more seriously than most of my colleagues have done.

ENERGY FOR THE ENVIRONMENT

Presented by

Colin F. W. Isaacs
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ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

It is with more than a touch of disappointment that I express my appreciation for the invitation to speak to you at today's Ontario Energy Choices Conference. My disappointment arises not from the conference itself, or from the many excellent expert participants in it, but from the tremendous amount of inaction which the Ontario government has managed to achieve in the area of energy efficiency in the last two years.

A few weeks ago, at a major announcement on municipal waste management, the Premier saw fit to describe some within society as "nay-sayers", a term traditionally used to describe conservationists who oppose environment-threatening developments proposed by governments. Fortunately, for the first point that I want to make today, the opposite term, "sayers", is the one that appropriately describes the Ontario government when it comes to energy and the environment. The Ontario government has itself produced all the right words and has expressed many times its commitment to energy efficiency and energy conservation, yet its own actions, and the actions of its agencies are almost invisible on the energy meters of the province. Here we are gathered once again talking energy options as if we truly had some!

In early 1986, and again in 1987, Pollution Probe hosted energy options conferences under the title Energy Forum. In March 1987, Jean Poirier, Parliamentary Secretary to then Energy Minister Vince Kerrio, told the opening session of Energy Forum '87 that "conservation and efficiency [are] a very important part of our policy agenda." Let me continue the quote. "Energy is vital to Ontario because it powers our economy, which is the strongest in Canada. Clearly, there are many challenges involved in making Ontario more energy efficient ... but I can tell you that the government is very firmly committed to a more energy-efficient Ontario - and that we intend to follow through on this initiative, to get results." I deeply regret that the government seems to regard getting results as saying, not doing, and just as Premier Peterson gets cheap shots by describing some groups in society as nay-sayers, so I'll end my cheap shot by emphasizing that Ontario's failure to enact real energy efficiency measures is caused by those who are sayers, not doers.

During the mid-1980's the term "energy conservation" was generally replaced with "energy efficiency". Barrack-room social theorists proposed that "conservation" had connotations of doing without, of cold, of darkness, of turning the clock back. Efficiency, on the other hand, was deemed to have positive connotations: effective use, making money, running a tight ship. Frankly, we all bought the argument, and "energy efficiency" became the watchword of the environmental and conservation movements. I believe that we were wrong. Today we live in a new era of environmentalism. People across Ontario are recycling their garbage in quantities that were not even imagined five years ago. Consumers are demanding environmentally sound products: the Green Consumers Guide has been a smashing success in the UK, having printed 240,000 copies, and the Canadian edition, of which Pollution Probe is a co-author, is poised to be an even greater success when it hits the bookstores and supermarkets in September. Canadians everywhere are concerned about the thinning of the ozone layer and about global climate change (the greenhouse effect), yet energy efficiency, the thing we can do most easily to reduce our impact on the global climate, is almost nowhere linked with global environmental conservation. I believe we must drop the phrase "energy efficiency", go back to "energy conservation", and start telling the public that recycling and blue boxes are just the beginning, that energy conservation is the path through which we can have the most direct impact on reducing the amount of global warming.

Let me illustrate further. A typical household, even a relatively conservation-minded household in Canada, without electric heat, uses about 30 kWhr per day, about 1.25 KWyear/year. If that electricity were all produced by fossil fuels, that household would be contributing almost 5 tonnes of carbon dioxide to the atmosphere each year, just through its electricity use. Let's add fossil fuel heating. A household in the southern part of Ontario can use 1,000 litres of heating fuel each season. Applying some simple arithmetic, we soon realize that we are facing production of another 11 or 12 tonnes of carbon dioxide each year. Well over 20 tonnes per household per year: the numbers could be refined but the message is clear: energy conservation equals environmental protection in a very major way, whether one's concern is climate change, acid rain, urban air quality, toxic chemicals, or whichever of our myriad interrelated problems you might choose.

On top of our own energy use, we must consider the very real need to provide energy supply to accomodate the undeniable aspirations of the developing world. At present per capita utilization, clearly inadequate in the growing world, this will mean an increase of 40% in global energy consumption by 2025. If developing nations are to achieve uniformity with our present consumption levels, an approach that I cannot in principle deny, the increase in global energy consumption by 2025 would be about 550%. Both figures are from the World Commission on Environment and Development, both are extremes, and both are quite scary, especially when we consider that atmospheric carbon dioxide concentration is growing at a rate of 0.4 per cent per year, and, according to respected scientists, is already substantially above the highest concentration experienced on earth in the past 160,000 years.

Canadians have been led to believe that depletion of tropical rain forests is the biggest contributor to global climate change. I suppose it is easy for governments to shift the blame half a continent away. Unfortunately, the facts prove otherwise. According to the prestigious Worldwatch Institute, in its 1989 State of the World report, humanity added 5.5 billion tons of carbon to the atmosphere in 1988 through fossil fuel burning and less than half as much through deforestation. If recent worldwide consumption growth rates of about 3 percent per year continue, fossil fuels could contribute 10 billion tons of new carbon annually in the year 2010. We are facing not just a greenhouse but a hothouse. Global climate change is no longer just in the realm of science fiction but is a phenomenon that has the potential to substantially destroy human life within the lifetime of our children's grandchildren. This talk is not the one I give to audiences of school kids.

Many will note that I have not discussed the nuclear option. Let me reassure you that it is not forgotten, only set aside, simply because Pollution Probe does not involve itself in research on nuclear issues. For a discussion of nuclear, I would refer you to the Brundtland report and its conclusion that "the generation of nuclear power is only justifiable if there are solid solutions to the presently unsolved problems to which it gives rise."

Let me come back to the fossil fuel burning issue. There are some well-meaning but misguided political and industrial leaders who are advocating solutions based on tree-planting in exchange for carbon emission rights. Unfortunately, such schemes, appealing in their simplicity, are based on a scientific misunderstanding. If all our burning was of biomass, in other words, recently cut trees and plants, we may be able to strike a balance with planting programs, but fossil fuels lie under land that is today, at best, supporting biomass: forests, fields, meadows or gardens. Fossil fuels are the carbon remains of dense tropical forests long since gone. Unless it is possible to grow forests at triple, quadruple, or even greater density, a feat we have not come close to achieving, it is absurd to contemplate that we can use today's biomass in ways that produce carbon dioxide and also grow biomass to take up the huge quantities of long buried carbon that we are releasing to the atmosphere through the burning of fossil fuels. The problem is made all the more intractable, of course, because we are losing the battle even on today's biomass. If trees for carbon dioxide programs are contemplated at all, their use must be limited to compensation for renewable biomass burning programs. Our fossil fuel carbon release can be compensated only by artificial production of coal, oil, or similar high carbon products and the burying of those products deep underground where the carbon is once again almost permanently removed from the atmosphere as it was in pre-Cambrian times.

What a depressing presentation! I have spoken often in recent months on the Brundtland Commission, on sustainable development, on "anticipate and prevent" instead of "react and cure", and on the success of working together to overcome our environmental problems. We must work together to overcome our energy problems too. We must identify programs which substantially reduce energy consumption. The first 15% will be the easiest. We must work together with society to redesign our lifestyle to achieve not just 15% but ultimately and quickly to make energy use sustainable, to reduce our energy consumption to levels which will accomodate the realistic aspirations of developing countries while reversing the planet-threatening situation which we have already caused.

The good news is that it is not too late, yet. We cannot avoid some climate change, just as we have not avoided acid rain, or toxic contamination of our fresh waters, or destruction of hundreds of millions of acres of forest, but I am convinced that we can slow and ultimately reverse the negative trends. To do so requires an integration of economic planning and environmental planning on a scale that only a few are beginning to understand. It makes no sense to talk about supply and demand without talking about the environment. It makes no sense to talk about energy needs without talking about the ability of the environment to accept those needs on a sustainable basis. It makes no sense to talk about gas or oil or electricity utilization without also planning for environmental improvements. In short, integration of environment and economy, the rhetoric of world leaders, including our own Prime Minister, can start at no better place that right here while planning Ontario's energy choice.

In the words of the sometimes pessimistic Worldwatch Institute, "the challenge is to act before it is too late - which means before the scientific evidence is conclusive. The longer society waits, the more radical and draconian the needed responses will be."

Let's cut the saying and just get on with the doing.

THE CHANGING ECONOMY

Presented by

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ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

The future can be very exciting to speculate about, but I have come to realize that the excitement should be tempered by the hard reality that one must first figure out how to get there. With respect to the economy, I am increasingly certain about only one thing: wherever it is we want to end up, the road we are taking will not get us there.

There are two trends that have been dominating my thinking for many years now: excessive consumption relative to production; and the cavalier attitude contemporary society is displaying toward the physical environment that is being left to future generations. (Pluralizing that last word is becoming more and more a "leap of faith".)

I have been asked to comment on where I visualize that the Canadian, and specifically the Ontario, economy will be going over the next five to ten years. This span is long enough so that it will encompass at least one full business cycle (although I no longer understand what a "normal" cycle constitutes). This means at least one significant downturn, something that is clearly "overdue" by conventional wisdom, and when the next one arrives it will present some severe tests to the world's economic policy leaders. I am going to assume that these tests will be met, mainly because there will be no defensible alternative but to do so. In any event, I am totally convinced that many things the opinion elite around the world are currently saying cannot (and even must not) be done, will be done to save the global system as we believe it ought to remain. The result will produce some major losses in "paper" wealth, but the sacrifices will be judged unavoidable.

The dominant force in the world economy over the past decade or so will continue for at least as long into the future. That force, commonly referred to as "globalization", is expanding quickly the geographic scope and intensity of competitive pressures on industries and factors of production that had grown comfortable under one form or another of protection. We are in the midst of a major transition that differs in degree but not in kind from the adjustments that were imposed on local markets that became regional or regional markets that became national in earlier periods.

This transition is far from painless, especially for North America. Lulled into complacency by natural resource abundance, this part of the world economy is suffering a serious erosion in its economic status because its citizens, in general, neither understand the meaning and importance nor practice the rules of individual and collective discipline. Instead, we mouth support for, and elect political leaders who extol the virtues of, free-market economics without knowing much about the limits of individualistic solutions to community-type problems. The power elite is doing well now, so don't worry, be happy! Meanwhile, those societies that can and do plan effectively for the future are in the process of, as they say, "cleaning our clock".

The Canadian economy has been growing rapidly since the late months of 1982 for essentially two reasons:

* The recession of 1981/82 was so deep for Canada that it provided a solid base for considerable non-inflationary growth. (At a national level, the "gap" that developed between actual and potential output has been exhausted, as reflected by the fact that the national unemployment rate fell by only 0.2 percentage points from February 1988 to February 1989 -- 7.8% to 7.6% -- despite robust demand growth in this period.)

* The rate of participation of the population in the labour force has increased to a record level in peacetime experience. Multi-income-earner families have increased their real incomes significantly in the past five years or so, but singles and single-parent "family units" are doing nowhere near as well on average. It is my sense that these developments are placing at major risk one of the dominant sociological developments of the earlier post-World War II era, namely the expansion of the relative size of the so-called "middle class" in Canada.

Neither of these developments will continue for the national economy. Indeed, the most important trends will be related to an ageing of the population and the resultant tendency for the participation rate to fall. (This demographic inevitability will progressively raise the policy and political importance of Canada's approach to immigration.) Therefore, if Canada is to maintain a "healthy" rate of economic growth in its potential output level, more of the gain must come from productivity improvements, but this has been an area of weakness relative to performance in the 1950 to 1975 period. Productivity is essentially a function of capital formation, which is in turn a function of savings. Canada can obtain financing for capital formation rather easily, at a price; the issue is whether that financing reflects our savings or those of some other society (payment for the use of which will serve as a major offset to future Canadian growth available for distribution to Canadians). Thus my preoccupation with excessive consumption in North America at an individual and a collective (i.e. governmental) level.

I have been talking thus far of the North American or of the national Canadian scenes. Ontario, or more accurately southwestern Ontario, has been dominating the national economy thus far in the post-recession period. There are a variety of reasons for this fact, but one stands out in my mind -- Ontario had become a relatively cheap labour area. Let me explain carefully what I mean by this.

International competitiveness reflects an interplay of three basic forces -- productivity, factor costs, and the relative value of the national currency (i.e. the exchange rate). Canada's national productivity in non-extractive sectors remains far below that in the United States. In one major sector, however -- the automotive industry -- Canadian productivity has become the equal of U.S. productivity because of the 1965 auto pact. This sector is heavily concentrated in southern Ontario.

Back in 1970, when the Canadian dollar was "pegged" at U.S. $0.925, the automobile union -- an "international" at that time -- extracted a commitment from the producers to maintain nominal wage "parity" between the two sectors of the now-integrated industry. When the Canadian dollar was released from its "peg" in 1970, it initially rose toward parity and beyond through mid 1976. But then the dollar slid to roughly U.S. $0.70 by 1985. Meanwhile, Canadian automotive productivity remained highly competitive with U.S. automotive productivity and Canadian automotive nominal wages stayed on a parallel course with U.S. automotive nominal wages. The result was a decided competitive advantage for the Canadian automotive sector, an advantage that has been moderated but by no means eliminated by the relative strengthening in the Canadian dollar over the past several years.

Passage of the Canada-United States Free Trade Agreement has broadened the relative attractiveness of manufacturing activity in Canada to many more sectors than the automotive. Even the anticipation that the FTA would be signed acted as a strong magnet for economic activity in the locationally attractive Golden Horseshoe at the western end of Lake Ontario. The rest of this vast nation is nowhere near as favourably situated locationally or industrially, and this situation must be averaged in with that in southern Ontario in determining the relative value of the Canadian dollar over the next decade.

What I have been saying tends toward a very positive outlook for growth in southern Ontario, and this view is implicit in the position that some business people I have been talking with have taken regarding the Canadian dollar. Parity with the U.S. dollar, they argue to me, is inevitable. My own political sense is that while our dollar may rise somewhat higher over time, parity would simply be unsustainable throughout most of the country. Therefore, over the longer term actions will be taken to keep our dollar down for regional development purposes (by, say, a significant narrowing, and possibly even a reversal, in the Canada-United States interest rate spread).

If Canada's relative productivity rises because of the FTA, and adjustment via the currency is prevented from being complete, some other adjustment mechanism will kick in. That something else will be factor costs, and I would argue that the process is already well-launched. Land values have surged in southern Ontario, which is one of the main factors slowing down further internal migration to this area. Prices more generally have risen much more here than in most of the rest of the country. And the rapid rates of increased population density has severely strained a broad range of social infrastructural services. It has become inevitable for some time now that relative wage rates in southern Ontario would be rising well above the national trend.

The message of what I have been saying boils down to some fairly strong lessons that Canadians are going to be forced to learn about regional economics over the next several years. In many ways this is a strange message for a country with the kind of regional diversity Canada possesses. But that diversity has led to political science-type diagnosis and commentary much more than to economic analysis that would be familiar to, say, location theorists.

All of this brings me finally to the theme of this conference, Ontario's Energy Choices. The one choice Ontario does not have over the next decade at a minimum is "cheap" energy. Indeed, I would be prepared to argue that energy availability is going to be at least as much of a growth retarding factor as anything I have mentioned thus far. There has been a great deal of what I would call hopeful talk to the effect that southern Ontario will grow through major expansion of the service sector, with "services" being defined broadly. Furthermore, it is often assumed, growth in services will allow us to conserve on energy demand. I am very sceptical.

For one thing, services are unlikely to thrive in areas without a manufacturing, or some fairly unique, base for generating value added. I am unimpressed with the claims of Toronto's uniqueness that I have heard, and with a weak automotive industry southern Ontario's economic performance over the past several years would have been nowhere near as robust as it was.

For another thing, it is unclear to me how much of an impact on energy demand there would be if a sudden further shift in Ontario's industrial structure toward services were to occur. There appears to have been a halt, and possibly even a reversal, in the decline in the U.S. energy intensity of growth, and I would be surprised if a broadly similar pattern were not observed in Canada. Relative energy price has proven a better predictor of energy demand growth than the industrial composition of the economy.

I want to close my prepared remarks on two somber notes. First, I fear that this Conference is occurring much too late to be able to assist very much in avoiding some fairly serious energy availability problems for Ontario sometime over the next decade. Second, it is to me a tremendous shame that Ontario has spent so much time and emotional energy in debating the negatives of the FTA that we are not well-prepared to take full advantage of the benefits FTA can bring to this part of the country.

CHANGING TECHNOLOGIES

Presented by

E. Philip Cockshutt
Executive Director, Engineering Programs
National Research Council of Canada
Ottawa, Ontario

ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

INTRODUCTION

In order to develop some appreciation of future energy demand, it is important to understand where technology seems to be headed, and hence what changes may be encountered in the major energy-using systems. The purpose is not to develop a blue-print for specific commodities or equipment, but rather to suggest overall trends and directions, which will influence the future scene.

Three broad developments seem particularly noteworthy in the current research and development climate; these can be summarized as "extended intelligence" "tailored materials" and "engineered organisms". While these do not encompass the entire field of technology development, they do constitute a significant fraction, and will each have a considerable impact on Ontario's Energy Choices.

EXTENDED INTELLIGENCE

The term "extended intelligence" is deliberately selected in preference to "artificial intelligence", a term which seems to be one of the most convenient, and hence one of the most overworked pieces of jargon in the current technology lexicon. Extended intelligence builds on the concept of A.I. or computer-assisted decision making, and combines it with two additional aspects, viz. distributed computation and advanced sensors. It appears certain that the engineering profession will be continuously involved with the concept of extended intelligence over the next two decades.

As noted above, artificial intelligence looks to computers to simulate human decision making. It goes beyond the simple performance of arithmetic, and the making of binary - yes or no - judgments based on that arithmetic. It incorporates the recognition of complex patterns in both space and time, and thus becomes self-teaching or adaptive. It extends on to decision-making in a best-estimate or probabilistic

.../2

sense, just as the human brain attempts to optimize the process of choosing among alternatives. In this context, one no longer works with a one-to-one correspondence between required data and available data, but moves to the real-life situation where there are either insufficient data or alternatively redundant data. Additionally, the system should cope with inconsistent data, and must attempt to identify and reject erroneous inputs. All these aspects are implicit in the transition from digital logic to artificial intelligence.

By way of example of artificial intelligence, it may be useful to consider first-hand experience with engine health monitoring - as applied to aeronautical gas turbine engines. At its simplest, health monitoring involves observing key engine operating parameters such as oil pressure and exhaust gas temperature, and ensuring that these are maintained within safe operating limits. However to be really useful, the system needs to cope with questions like "are these values typical of a healthy engine operating at these same engine operating conditions?" and "are these pressures and temperatures internally consistent with each other, or are certain data suspect?" Additionally, the artificial intelligence system needs to present the engine health information in a fashion that can be rapidly and unambiguously assimilated by flight deck crew. Clearly the aircraft application, where the engine way be worth 3 or 4 million dollars, and where engine health is vital to flight safety, has a compelling justification. What is happening now is the extension of health monitoring techniques to other forms of transportation powerplants, to resource industry machinery, to process control equipment, etc.

The progress in artificial intelligence is primarily in software - in devising programming approaches that more closely follow thought processes. Hardware developments however are equally important in the evolution of extended intelligence. Computing elements are becoming smaller, cheaper, faster and more reliable, so that tasks that formerly required mainframe terminals, or expensive dedicated units, can now be handled on a dispersed basis. In the engine health monitoring example, when it was first studied twenty years ago, it appeared that the required analogue computer might amount to 10% of the cost of a new engine. Now the computer is inexpensive relative to the required sensors.

In another example of distributed computation, one may consider the enhancement of the home thermostat. Not only can it provide time-wise control for the operation of the heating system, but it can also sense outside conditions and hence anticipate optimum operating schedules. It can potentially also assess air quality, humidity levels, etc to operate secondary air exchange systems, to say nothing of performing security, comfort and aesthetic functions within the house.

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The third element in extended intelligence relates to the devising of specialized sensors, to provide input to the sophisticated software and ubiquitous hardware, as described above. By way of example, in the control of a lumber mill, one needs conventional information on the mechanical systems like motors and saws of the mill, but also on the geometry and composition of the lumber feedstock coming for processing. With optical scanning devices, one may sense the shape of the trunk, and decide on the best cutting pattern given current demand and economics; with a new chemical sensing technique known as ion mobility spectrometry (IMS), one can identify the tree species, and even certain forms of infection, and so regulate the mill operations.

Another example of specialized sensors involves the detection of tiny particles of plastic, which seriously contaminate wood pulp for fine papers; the principle under development is that of near infra-red reflectance analysis (NIRA), which appears capable of detecting particles as small as 1mm in diameter, at scanning speeds of 6m/s.

In summary, extended intelligence offers a range of technologies which should have a major impact on energy supply and demand in the future - by permitting optimized control of systems and processes, while minimizing waste and environment burden.

TAILORED MATERIALS

Classically the emphasis in Canada in supplying materials has been on the volume production of "commodities" of standard quality - such as aluminum ingots, or sawn lumber, or rolled steel sections. Canada has over the years derived a large portion of its economic health from the supply of these commodities. However attractive this supply role may appear, it is not without threats - from depletion of rich resources, from substitution, and from environmental sensitivities.

Increasingly, attention is shifting to high-value-added products, where the emphasis is on carefully matching the material to the geometry and function of the component manufactured. By way of example one may consider the production of cermaic valve heads and combustion chamber inserts for internal combustion engines. It has long been recognized that the efficiency of reciprocating engines can be significantly improved by operating at higher cycle temperatures, and furthermore, that engines can operate with less refined fuels with those higher temperatures - this becomes distinctly possible with appropriately tailored structural ceramics.

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An additional example of tailored materials is offered by engineered wooden structures - the MacMillan Bloedell development of parallam beams - which are designed to achieve optimum structural function by laminated construction techniques. Similarly, special rugged parts can be produced by using laser treatment for localized surface hardening, without loss of core properties of the material. In yet another example, recent developments in tribology are permitting more suitable materials for special purpose braking applications, such as arrestors for the space arm.

In summary, then, the technology of the coming decades will increasingly feature specifically optimized materials to fulfill specialized functions - there will thus be considerable scope for supplying high-value components to niche markets, on an international scale.

ENGINEERED ORGANISMS

The third area of technological development which seems to be of particular significance in characterizing the future is the field of biotechnology, which has of course been expanding rapidly during the past five years. It is clear that even now biological techniques are becoming an important element of the operation and control of engineering systems. It is also clear that these biological techniques are providing new possibilities for processes that are more environmentally benign. Although there clearly are limits to what biotechnology can do, there will be some very impressive achievements in the coming years.

One of the most important recent developments has been the evolution of Bacillus thuringiensis (Bt), as a mechanism to combat the infamous spruce budworm, which formerly required spraying with DDT. It has been found that the Bt bacterium can be sprayed in a fashion that has no discernable effect on humans or other higher order animals; however protoxin crystals produced during sporulation, when ingested by certain lepidoptera, produce toxic polypeptides which prove lethal to those species. Considerable testing has already been done with full-scale aircraft spraying, but one problem has emerged - this is a degradation of the crystals in the presence of direct sunlight. Work is currently proceeding to modify the genetic structure of Bt, in an attempt to reduce or eliminate this sunlight deterioration phenomenon.

Biotechnology also offers promise in the recovery of heavy metals from mines tailings, working at very low concentrations which would be uneconomical by any other techniques. This bioleaching appears to proceed without significant adverse environmental impact. It also appears that pulp mill wastes can be more effectively treated by anaerobes than by conventional chemicals, and investigations are proceeding to improve the economics and control of this process. These and other applications of biotechnology will undoubtedly affect energy supply and demand in the coming decades.

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SUMMARY

Changing technologies will have a major effect on both supply and demand for energy in Ontario. It is impossible to identify their exact form and impact, but three areas of development are almost certain to be significant:

- extended intelligence
- tailored materials
- engineered organisms

These, along with economic, demographic, and resource considerations will all play their role in determining the ultimate supply/demand equation.

HANDOUT

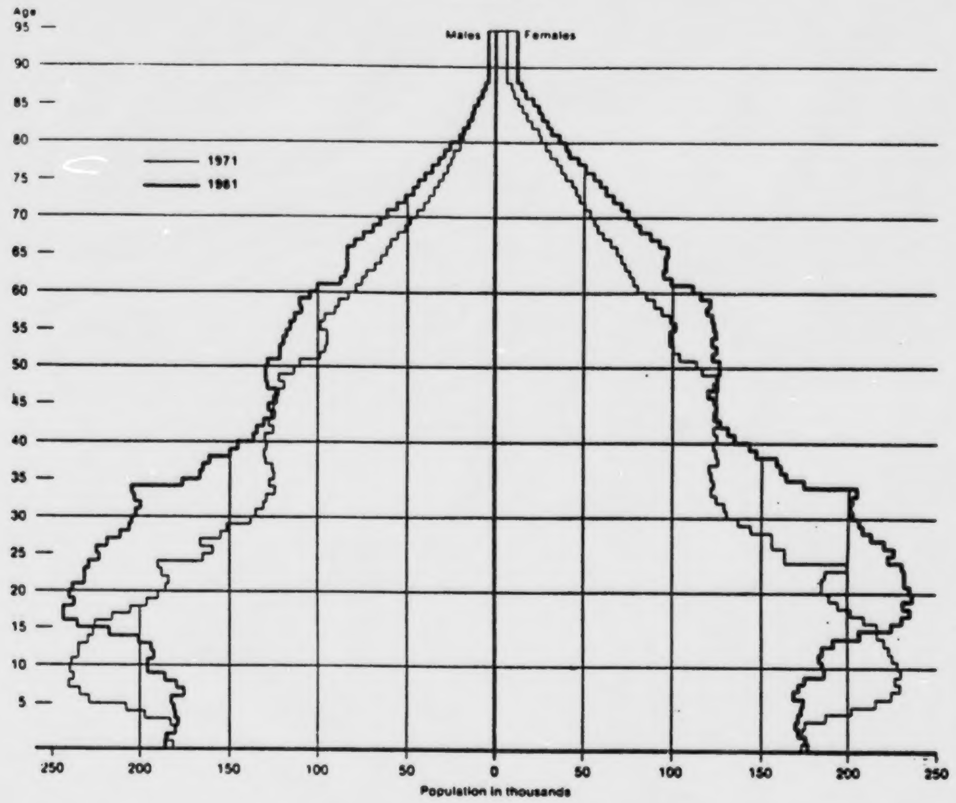
from a presentation by

Prof. David K. Foot
Dept. of Economics
University of Toronto

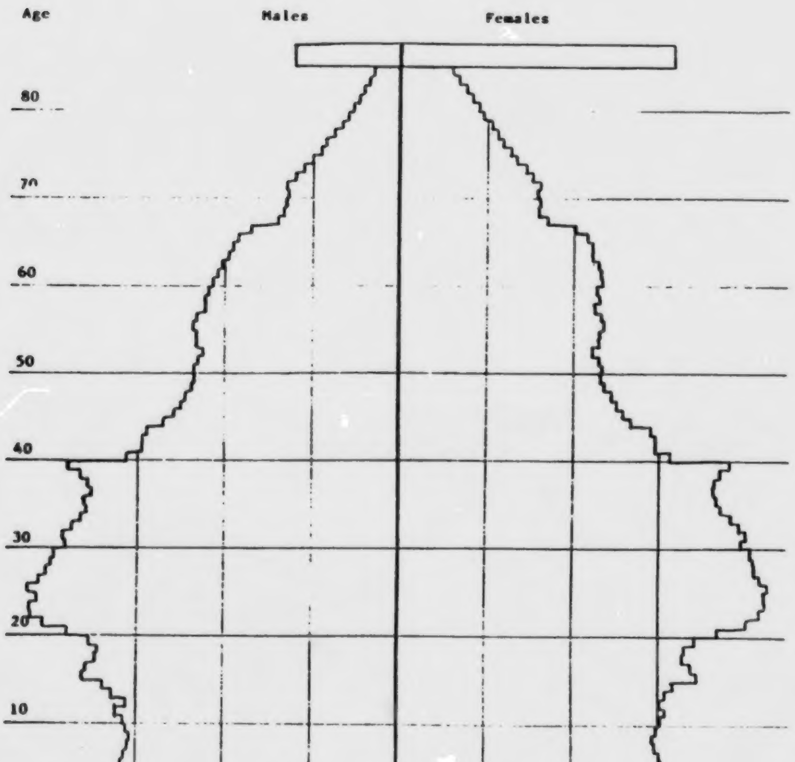
ONTARIO'S ENERGY CHOICES CONFERENCE

Toronto, April 3, 1989

CANADA



AGE PYRAMID, ONTARIO, 1986



HANDOUT

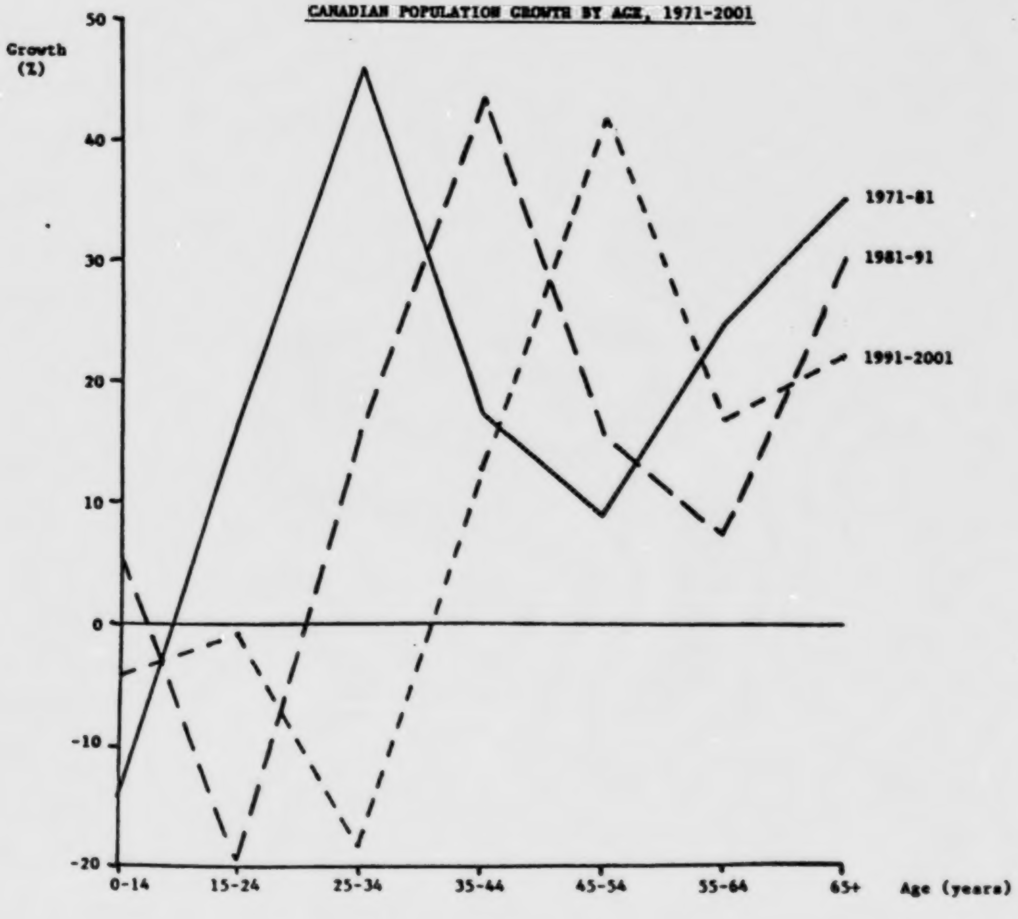
Prof. David K. Foot
Dept. of Economics
University of Toronto
(416) 978-6128

CANADIAN POPULATION GROWTH BY AGE, 1971-91

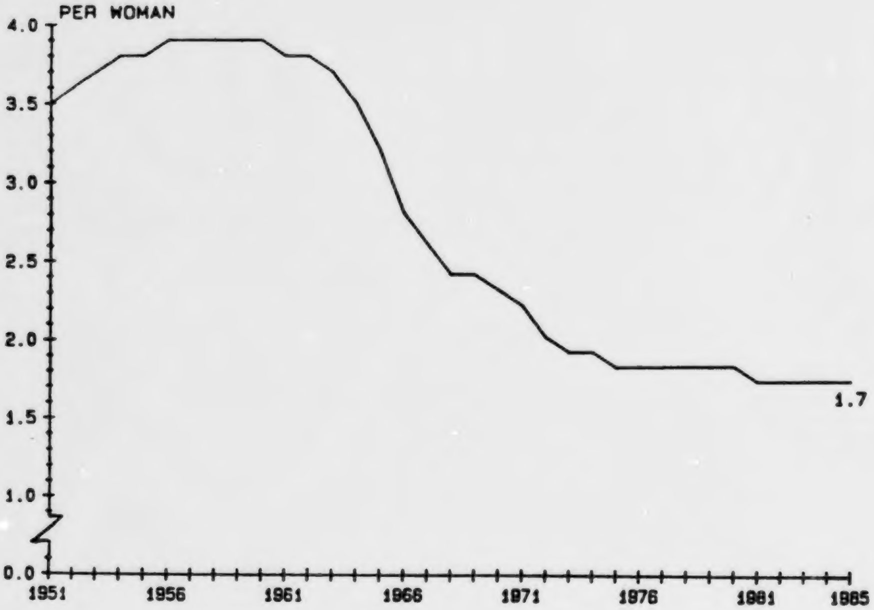
Age (Years)	Growth (Percent) 1971-81[a]	Growth (Percent) 1981-91[b]
0 to 14	-14.1	5.2
15 to 24	16.4	-19.6
25 to 34	45.9	15.8
35 to 44	17.5	43.4
45 to 54	9.0	15.8
55 to 64	24.7	7.5
65 & over	35.3	30.3
Total	12.9	10.6

Notes: a. Actual.
b. Projections by the author.

Sources: Statistics Canada, Catalogue Nos. 91-521 and 92-901, and projections by the author.


CANADIAN POPULATION GROWTH BY AGE, 1971-2001

TOTAL FERTILITY RATE, CANADA, 1951-1985



Source: Statistics Canada.

LIFE EXPECTANCY AT BIRTH

CANADA, 1921-81

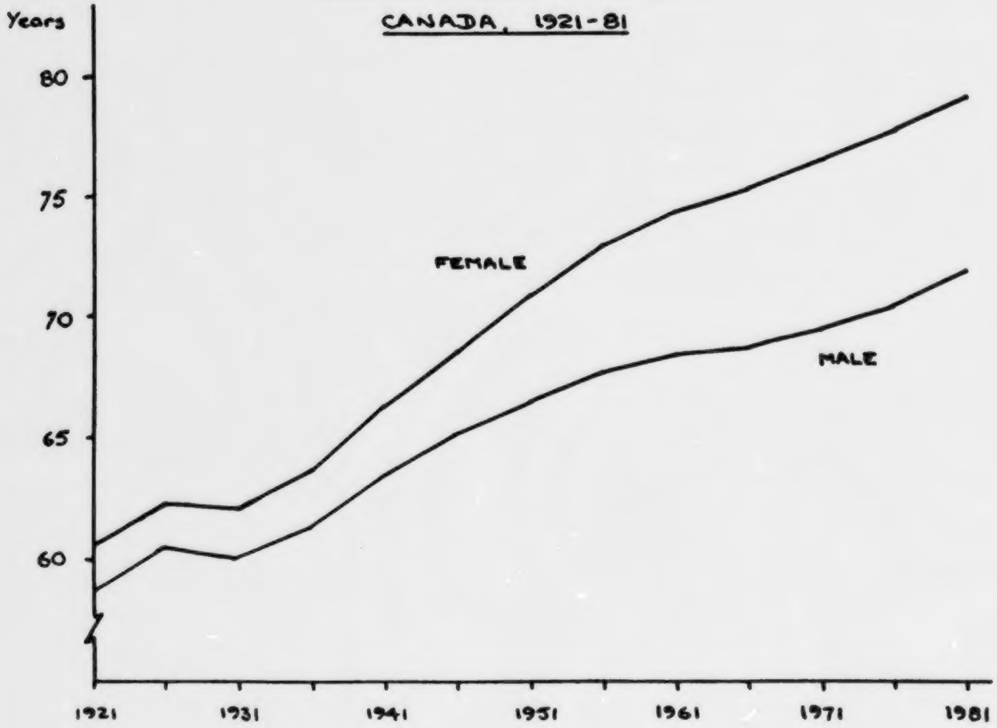
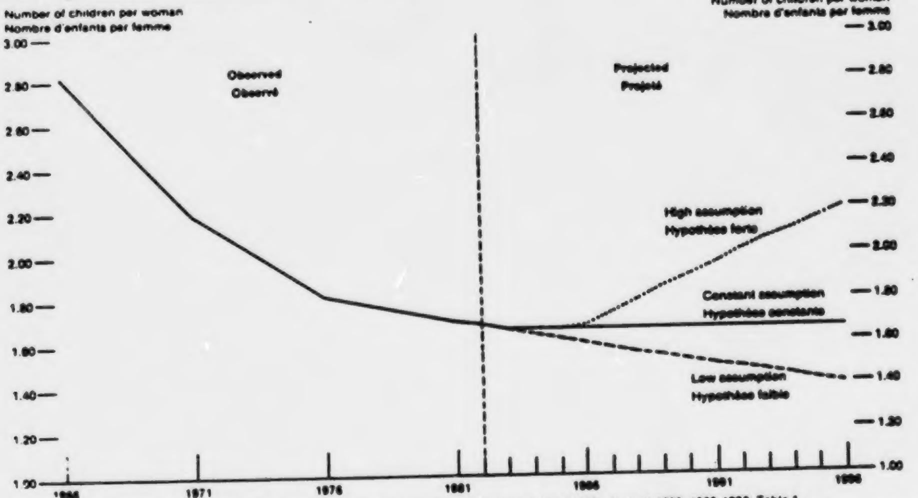


Figure 1

Total Fertility Rate for Canada, 1966-1996

Indice synthétique de fécondité, Canada, 1966-1996



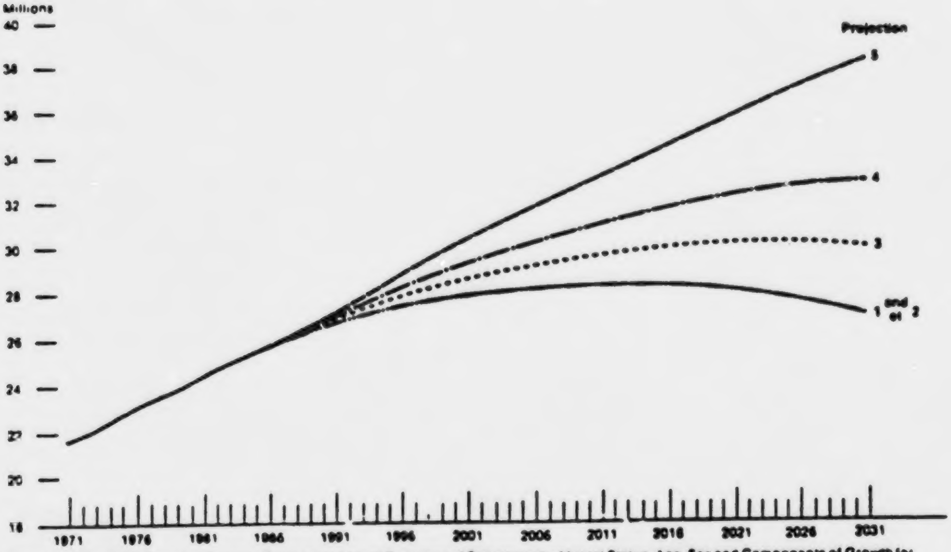
Sources: 1966-1982: Statistics Canada, Vital Statistics, Vol. 1, Births and Deaths, Catalogue No. 84-204, annual; 1983, 1983-1996: Table 1.

Sources: 1966-1982: Statistique Canada, La Statistique de l'état civil, vol. 1, naissances et décès, nº 84-204 au catalogue, annuel, 1983, 1983-1996: tableau 1.

Figure 4

Trends in the Total Population of Canada, 1971-2031, According to Five Projections

Évolution de la population du Canada, 1971-2031, selon cinq projections



Sources: 1971-1983 Statistics Canada. Postcensal Annual Estimates of Population by Marital Status, Age, Sex and Components of Growth for Canada and the Provinces, June 1, 1982 and 1983, Vol. 1, Catalogue No 91-210, annual, 1984. 1984-2031: Detailed tables, Part II

Sources: 1971-1983 Statistique Canada. Estimations annuelles postcensitaires de la population suivant l'état matrimonial, l'âge, le sexe et les composantes de l'accroissement, Canada et provinces au 1er juin 1982 et 1983, vol. 1; nº 91-210 au catalogue, annuel, 1984, 1984-2031 tableaux détaillés, partie II

Figure 6

Population by Age and Sex, Canada, 1981 (Census), 2006 and 2031 (Projection 1)

Population selon l'âge et le sexe, Canada, 1981 (recensement), 2006 et 2031 (Projection 1)

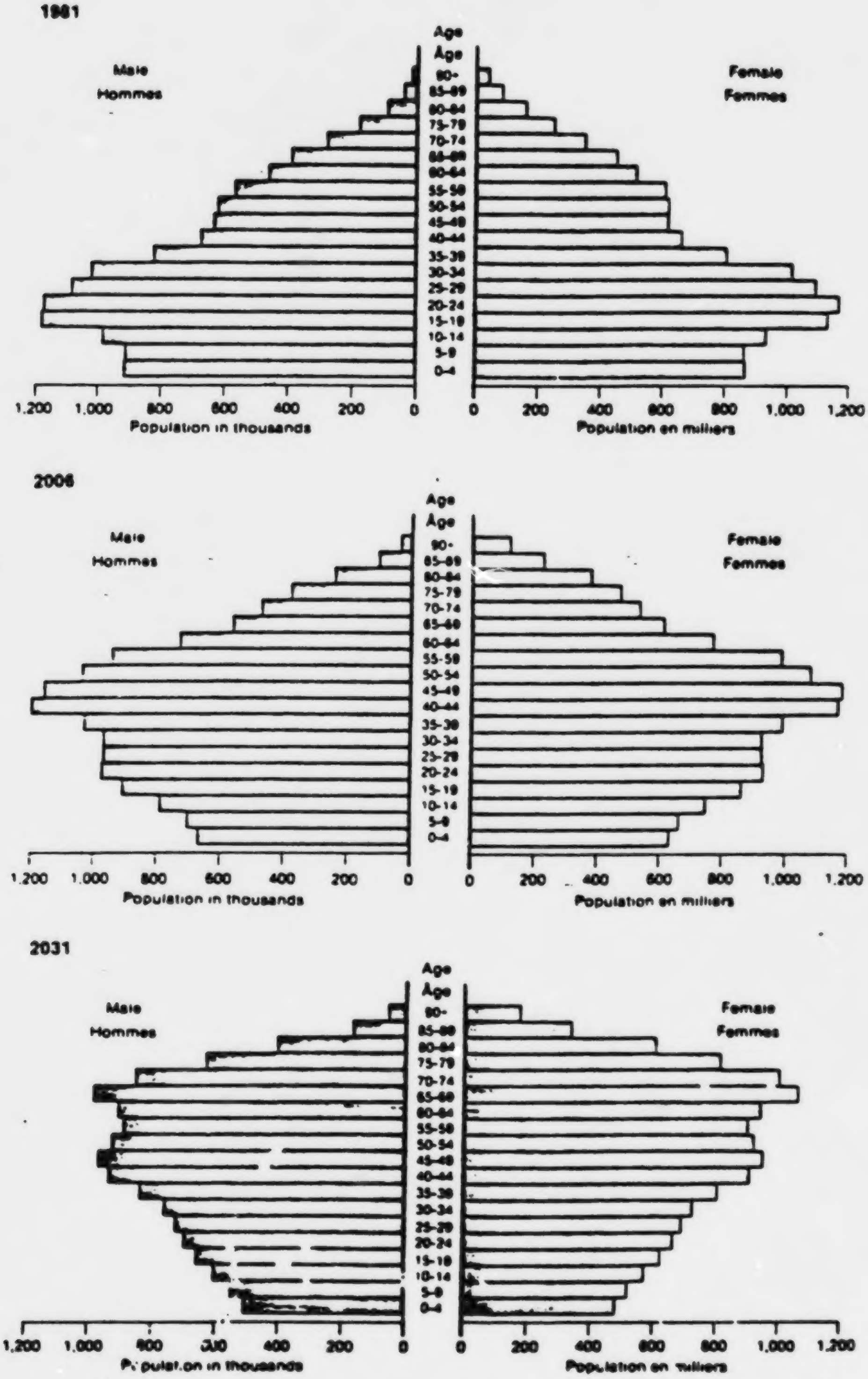
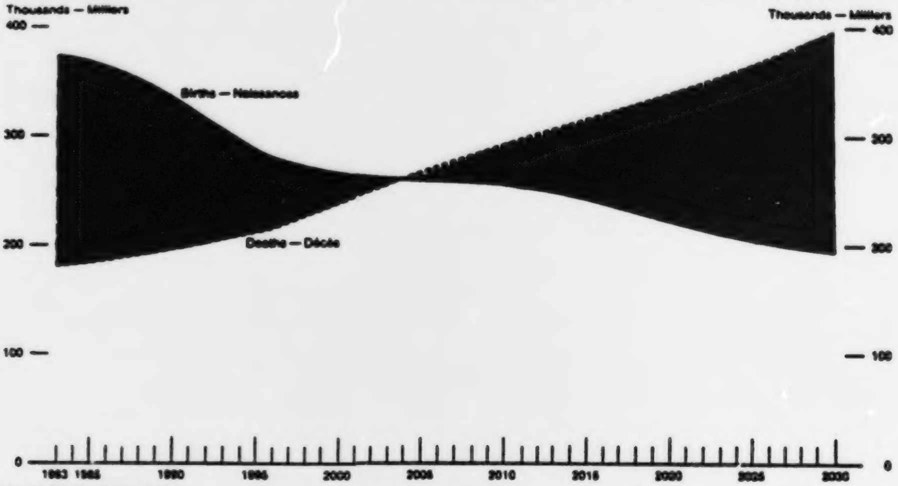


Figure 5

Projected Births, Deaths and Natural Increase, Canada, 1983-84 to 2030-31 (Projection 1)

Nombre projeté des naissances et décès et accroissement naturel, Canada, 1983-84 à 2030-31 (Projection 1)



Source: Detailed Tables, Part II
Source: Tableaux détaillés, partie II

HISTORICAL AND FUTURE MEDIAN AGE, CANADA, 1851-2051

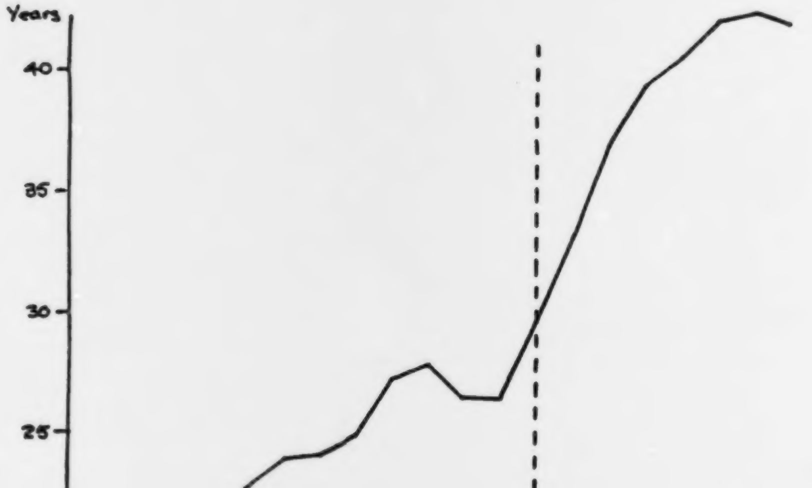


CHART 1

CONSUMPTION, INCOME AND SAVINGS

POOLED RESULTS, 1964-1978

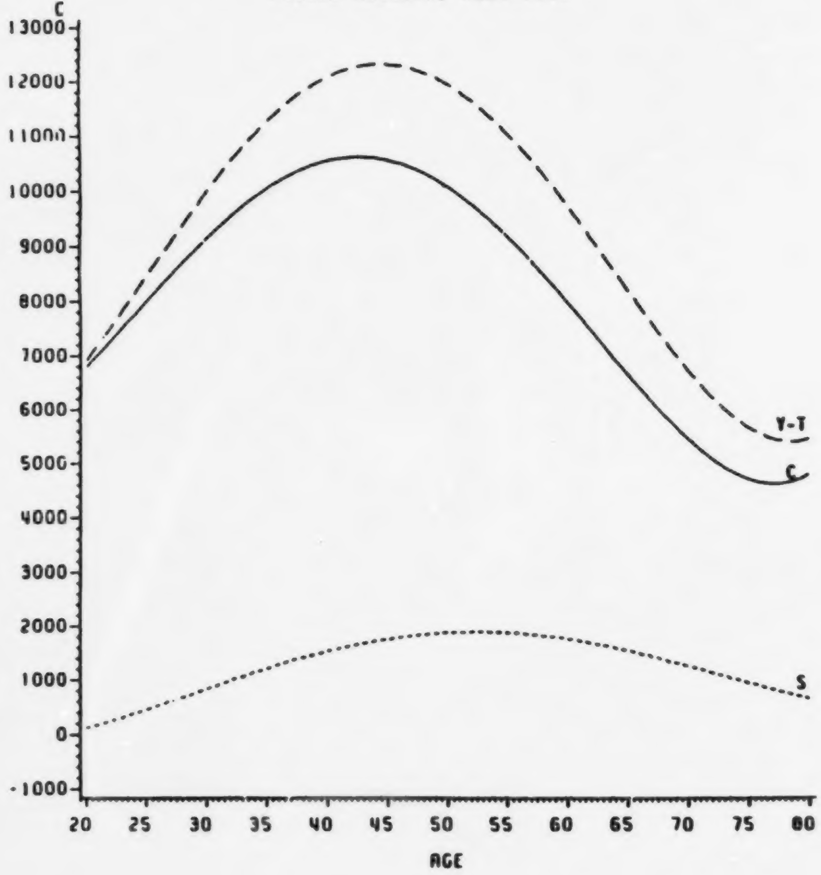
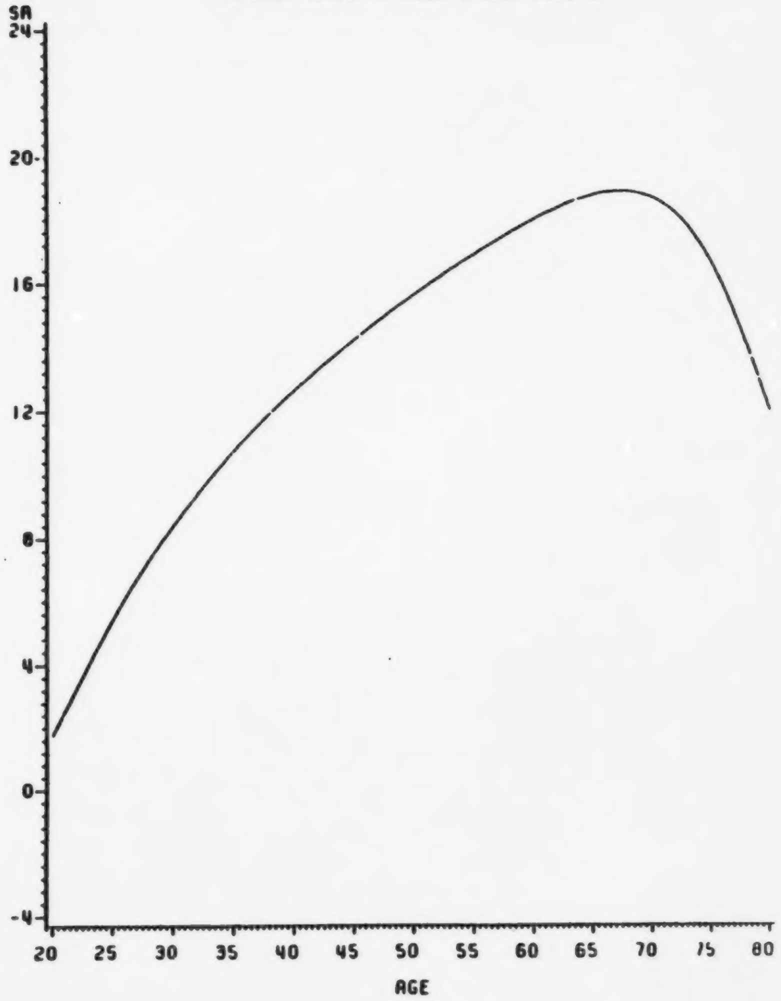


CHART 2

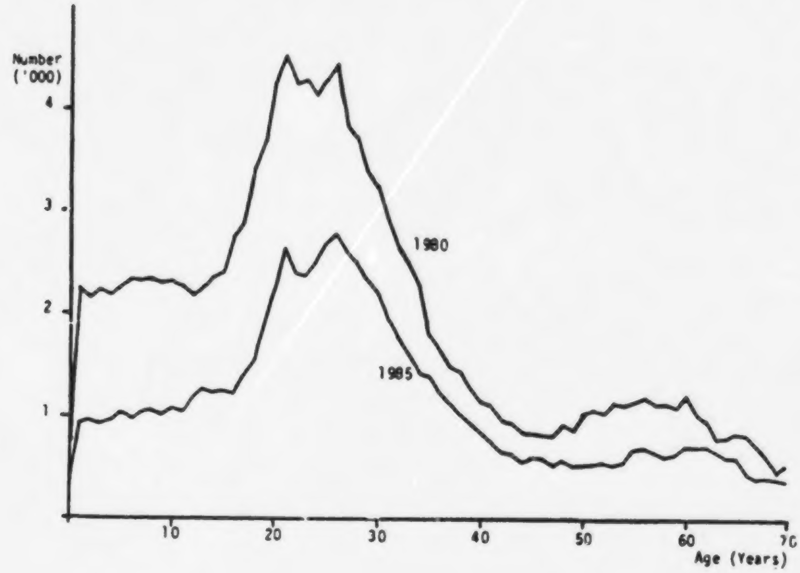
SAVINGS RATES

POOLED RESULTS 1960'S AND 1970'S



APPENDIX I

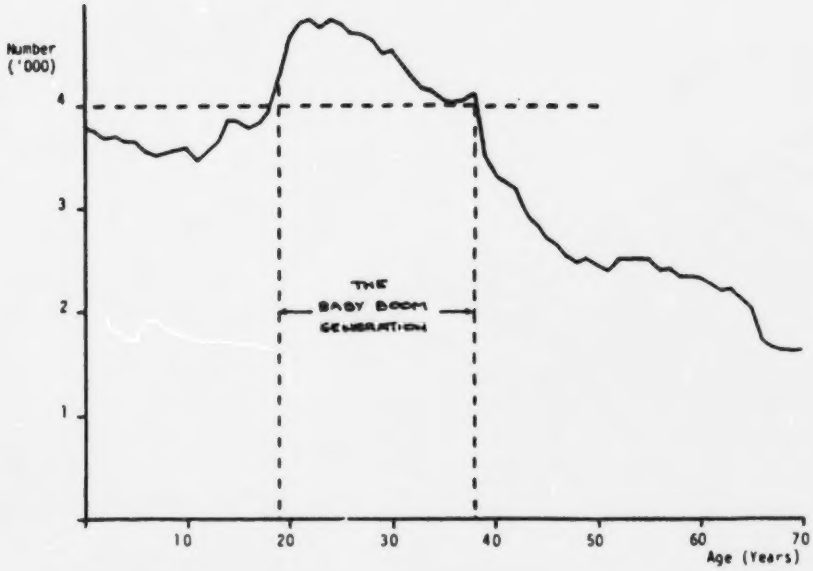
THE AGE DISTRIBUTION OF IMMIGRATION, CANADA, 1980 AND 1985



SOURCE: Employment and Immigration Canada.

APPENDIX II

THE AGE DISTRIBUTION OF THE POPULATION, CANADA, 1985



SOURCE: Statistics Canada.

Baby boom workers finding there's little room at the top

By Barrie McKenna

Financial Post

JAMES DREW, 35, started working at Widget Co. as a sales trainee in 1978. He survived massive staff cuts during the recession, and gradually worked his way up to district sales manager. Now his sights are fixed on the director of sales job.

But with 10 co-workers vying for the same job, he probably won't get it.

The generation that overpopulated schools in the '60s, couldn't find work in the '70s and created a housing boom in the '80s has spawned a new problem.

Baby boomers — those born between 1947 and 1966 — are clogging up the corporate hierarchy as they move into lower and middle management. There are now thousands of them waiting to move up the ladder, but few openings at the top, says demographics expert David Foot, an economics professor at the University of Toronto.

Unemployment among 35-44-year-olds will leap by 43.4% between 1981 and 1991, Foot says. Meanwhile, fewer young people are entering the work force, lowering unemployment among 15-24-year-olds by 20% during the same period.

"The corporate structure that has served us beautifully until now is no longer appropriate," Foot says. The perfect match between the age of the population and the typical corporate hierarchy occurred in 1979-80, when the bulk of the population was at the corporate entry level — 15-25 years old. Now, the upper end of the baby boom is 42, and the largest baby boom group is 27.

Foot warns that the career path of the baby boomers is about to hit a plateau.

"Opportunities for promotion will be severely limited throughout the 1990s," he says.

Start businesses

As a result, companies will have an increasingly tough time keeping employees motivated and happy.

Drew, a fictional employee, will have to take a lateral move or join the swelling ranks of workers who have abandoned the corporate grind to start their own businesses. At 10,000 per month, the rate of new business incorporations is double the 1982 pace, according to a regular survey by Small Business magazine. Foot says it's proof his research is accurate.

"Companies are going to have to find ways to give people a new challenge — and pay them for it," Foot says. "If companies want to stop the dissatisfaction that is starting to brew at the front end of the baby boom, the notion of salaries related to hierarchy within the corporation has got to go."

But moving people laterally is not the answer to dissatisfaction, says Al Beech, president of Drake Beam Morin Canada Inc., Toronto relocation counselors. "A company can move somebody sideways a couple of times," he says. "But a person will start looking externally if he's moved sideways too often."

U of T's David Foot: 'Corporate structure no longer appropriate'

Beech says executive search firms get a flurry of calls from disenchanted workers every time they run a want ad.

Making matters worse, companies cut out layers of management and consolidated job descriptions during the recession. Layoffs and early retirement programs made corporations lean and mean, but they also cut into promotion opportunities.

Many companies are tackling the problem with the psychological approach — getting employees to lower their expectations rather than changing compensation strategies.

Toronto-based Imperial Oil Ltd., which "downsized" in 1982 and 1986, has relied on improved communication to solve the baby boom bulge.

"We try to get employees to think about what they would like to do next," says Hugh O'Neill, Imperial's manager of human resources, "not necessarily in an advanced position or a promotion, but one at the same level; potentially at the same salary, maybe even in another location."

"The concept of moving up from one level to another is on the way out," says Anne Lackie, manager of human resources at Royal Bank of Canada in Montreal. "We talk more about career paths these days, rather than a career ladder."

Two years of rapid growth in central Canada, especially in the telecommunications field, has largely masked the problem at Montreal-based Bell Canada, says Robert Peacock, assistant vice-president of compensation, human resources and corporate education. But between 1980 and 1985 the company reduced its overall head count by 10%-11%.

"All the symptoms will return when the economy slows down," he says.

At least one employer has taken more drastic steps. In late 1986 the Ontario government implemented its "strategy for renewal" program to cope with the dearth of new recruits and bulge in middle management. The program includes a voluntary exit option, with incentives for people to quit at all levels of its ministries.

"You may lose the some good ones in the process, but it improves the work force hierarchy," says George Podrebarac, former assistant deputy minister of Ontario's Human Resources Secretariat.

Demographics expert Foot says employers are going to have to get even more innovative in the 1990s. To keep good employees they'll have to offer rewards for moving laterally, more generous educational leaves and better vacation packages. Promotions, power and seniority are on the way out.

"The employee is going to have to have a value to the company, not the position," Foot says. "An employee has to be rewarded in whatever position he's in."

JANUARY 1989

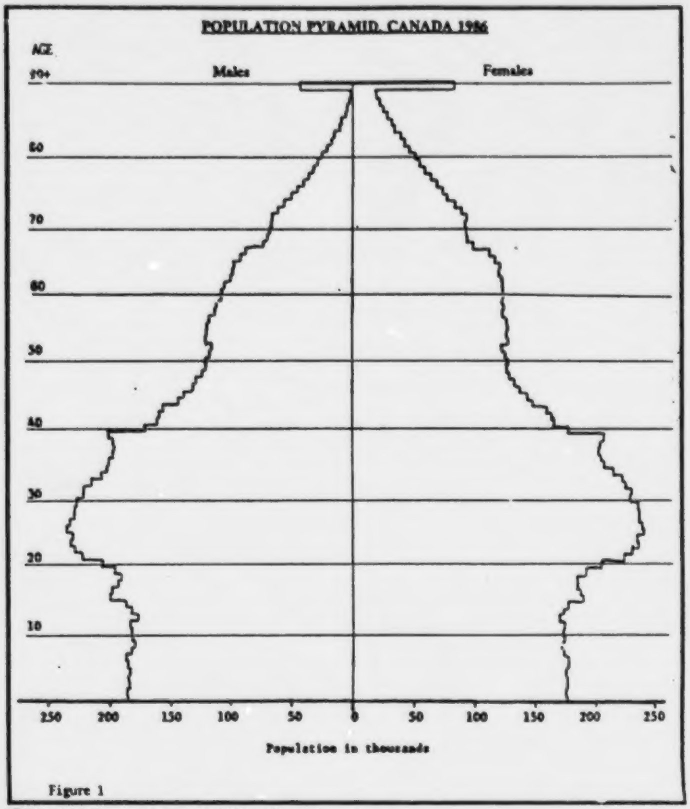


Figure 1

David Foot, Department of Economics, University of Toronto

I would like to give you an overview of what has been going on in the Canadian education system and labour market from an economic and demographic viewpoint. I will focus on the 1990s, and the punch line is going to be that the 1990s will be dramatically different from the 1970s and 1980s. So that if you look too much at the trends of the 1970s and 1980s and too much at your experiences of the 70s and the 80s, you're going to be missing the boat in the 1990s.

It was no surprise that over the 60s and 70s the education system in Canada exploded. We were educating the baby boom generation. Those born in 1947 reached age 16 and 17 by the mid-60s. Thereafter, wave after wave of baby boomers came into the education system. By the early 80s we were dealing with the big group; the labour market was flooded with bachelor's degrees. Is it any surprise that the return on a bachelor's degree plummeted? Of course it plummeted, and of course people had difficulty getting jobs. The labour market was flooded with baby boomers. Employment became a major problem.

But what has been going on over the 80s? Remarkably, in recent years, my undergraduate students have found it easier to get jobs. The back end of the baby boom is now 22 and the bachelor's degree is beginning to become a scarce commodity again. Besides getting jobs in the next decade, graduates will also get slightly increased salaries.

New entrants into the labour force are coming from successively smaller cohorts — the "baby bust" generation born between 1967 and 1980. The labour force growth of the 60s and 70s, which gave us a lot of our cumulated placement problems of the late 70s and early 80s, has been cut in half. Labour force growth has fallen from over 3% a year to around 1.6% a year over the 80s.

Forget about the problems of the traditional student. They are going to price the market and they are going to have no difficulty getting jobs. Youth unemployment rates are already falling. But a new problem is emerging. Have you ever thought how we structure our organizations in Canada? Governments are a good example. Think of them as tall pyramids. In government, for example, we have a deputy minister, then a couple or three assistant deputy ministers, and then there might be some associates, then executive directors, and so on.

Have you ever thought what it's like to work in an organization where everybody wants to be the boss and there is no one around to do the work? That's what's coming in the 1990s. David Foot

These pyramidal or triangular structures work extremely well when there is a triangular labour force. But the base of the population pyramid started falling in over the mid-60s (see Figure 1); so the base of the labour force pyramid is going to start falling in the mid-80s. There will be many fewer younger workers around. Structural organizations which function on the presumption that there are a lot of people at the bottom and very few people at the top work very well until there is nobody at the bottom.

Have you ever thought what it is like to work in an organization where everybody wants to be the boss and there is no one around to do the work? That's what's coming in the 1990s. The baby boomers are moving up. Have you ever tried to take an aging baby boom and move it up a triangular pyramid? It doesn't work. There is already lots of dissatisfaction springing up amongst employees aged about 35, 34, 36. They're looking at their bosses and finding their bosses are 42; they say to themselves: "I'm going to have to wait 15 years for that turkey to move on before I can have his or her job".

Corporate Canada has a real conundrum on its hands and it generally doesn't understand it. There is nowhere for the baby boomers to get their promotion. How are the baby boomers going to be motivated? Instead of linear promotions, there will have to be lateral promotions. And when you use lateral promotions, you're going to take your director of finance and your director of government business relations and your director of human resources, call them in one day and say: "Gee! Have I got the best deal for you guys! You're going to take one another's job next month. A whole new set of challenges: now get back to school and learn whatever you need to know!".

That's where education comes in during the 1990s. The plateauing baby-boom, as with the lateral moves, will require courses. And they will not be just job-oriented courses; they will be courses in subjects such as ethics. They may not want to take degrees. Don't worry about whether they will take degrees or not; that's not the issue. They don't have time to take time out from their jobs to take a whole degree, but they will need courses and they will need high-quality courses. These courses will be paid for by the employers; so, with luck, we will be able to diversify the funding base a little bit. But, we've got a problem here: if they go back to school, will they go back to community colleges or universities? The evidence seems to be that they are coming back to universities.

David Foot, University of Toronto

Recruit younger immigrants, specialist says

BY ROSS HOWARD
The Globe and Mail

Canadian immigration policy is adding to the trials of the Baby Boom generation and should be changed to ease Canada's problems of employment and aging, an immigration and population specialist says.

The biggest change would be a new policy that recruits younger immigrants to meet the need for younger workers now that the Baby Boomers — those born in the 10 to 20 years after the Second World War — are growing older.

The biggest problem will be to find replacements for adults born in the post-war years, says David Foot, a University of Toronto economist. Concentrating on countries with large populations of young people over the next two decades could entail a change in the mix of race, religion and nationality now admitted to Canada.

In a paper recently presented to a Manitoba meeting of the Canadian Population Society, Mr. Foot said a new age-directed immigration policy should, and could, be introduced quickly, making a person's birthdate one of the key criteria for admission to Canada.

People born during the so-called Baby Boom between 1947 and 1966 make up the largest block of Canadian residents now — there are more than 400,000 residents for each age between 20 and 39 years of age, the peak being 485,000 who are aged 26 now. As they grow older, they reshape Canada's population profile: between 1971 and 1985 the median age of Canadian residents rose to 31 years from 26, and by 1999 it will be 37.

Although political focus is on the problem of unemployment among youths aged 15 to 24 years, the aging of people born during the post war years is affecting the unemployment problem. By 1984, the unemployment for 25- to 34-year-olds rose above the national average for the first time.

With the Baby Boomers matured and a lower rate now of young people entering the labor force, the higher rates of unemployment will follow the aging population, Dr. Foot said.

"Youth unemployment was largely a problem of the 1970s, young adult unemployment is the emerging problem of the 1980s and this will spread to older workers over the 1990s," he said.

Canadian immigration policy adds to the problem. Almost half of all immigrants to Canada since 1980 are 20 to 39 years — the same age as Canadian Baby Boomers, according to Statistics Canada figures cited by Dr. Foot.

These immigrants add to already tight competition for jobs among the largest segment of the population and will aggravate the problem into the 1990s, while leaving a 20-year downturn in the supply of young workers, which won't be alleviated until the children of those now in their 20s and 30s enter the job market.

In his paper, which was prepared with assistance from the federal Immigration Department, Mr. Foot urges Canadian immigration policy be changed. He suggests concentrating on immigrants who were born between 1968 and 1986 and who will be 14 to 32 in the year 2000.

Mr. Foot recommends adding an extra 18,000 immigrants per year above the current 100,000 into Cananda, with the additional immigrants selected by age to match future needs of the labor market. The new policy could be refined to encourage "age-directed immigration by gender and province of destination."

Planning now for burden of elderly 'boomers'

TORONTO STAR JAN 18, 1989

DAVID CRANE

BRUSSELS — The baby boomers are beginning to sprout gray hair. That huge wave of Canadians born in the golden postwar years from 1947 to Expo '67 and who gave us both hippies and yuppies, is getting older.

The earliest baby boomers are now in their 40's and growing into middle age. And by the year 2012, which is not as far away as you think, these baby boomers will start to turn 65.

Every generation ages, but the sheer numbers of baby boomers turning 65 not that long from now will raise all kind of challenges in housing, jobs, health care, pensions, consumer spending, education, social services and federal and provincial budgets.

And it is these challenges, two University of Toronto experts argue, that we should start thinking about now. Blossom Wigdor, who directs the University of Toronto's program on gerontology or ageing, and David Foot, a University of Toronto economist, have written a new book, *The Over-Forty Society: Issues for Canada's Ageing Population*.

In it they present a hopeful view, not only on the ability of Canadians to enjoy productive and useful lives well beyond the age of 65 but also on how we can avoid many of the risks in a society where fewer workers will have to support more retirees.

By themselves, the projections for our ageing society are dramatic. The number of Canadians 65 and over has risen from just 1.1 million in 1950 to nearly 3 million now and is expected to reach 7.7 million by 2030. And their share of the population will [illegible] up from 7.6 per cent in 1950 [illegible] per cent in 2030.

But while today's 30- and 40-year-olds can expect an attractive set of choices by the time they reach 65, there's no doubt, as Wigdor and Foot point out, that an ageing society raises concerns as well.

One is that not all older Canadians will share in these future choices; more than half of Canadians do not have private pension arrangements.

Another is that there will be a dramatic increase in the number of Canadians 85 and over, and most will need special care. And then, of course, there are fears about the financial burden caused by rising health care and other social costs.

The financial costs of an ageing society could be high, perhaps intolerably high for the children of baby boomers paying taxes to support social and health programs. According to the Organization for Economic Co-operation and Development in Paris, 1980 per capita social spending including health care in Canada was $2,462 for those aged 14 and under, $1,772 for those aged 15-64 and $6,535 for those 65 and over.

In a recent study, *Ageing Populations: The Social Policy Implications*, the OECD calculated that for Canadians to hold social spending at the 1980 level of 21 per cent of the economy, they would have to average economic growth of 5 per cent a year in 1980-2040.

We did that for much of the '60s and '70s. But in the '80s our growth has averaged barely 3 per cent a year. So if we are to cope with an ageing society, strong growth and rising productivity will be a big help.

But lots of other changes will be needed, Wigdor and Foot argue, for example, in health care. "If we continue to deliver health care that places a heavy emphasis on cure and institutionalization, the costs will become unbearable," they warn.

Instead of placing seniors in institutions, there will have to be more community services to help older Canadians live on their own and new forms of housing for seniors where their health can be monitored but at lower cost.

Governments will have to pay more attention to ensuring Canadians will have adequate pensions and that the pension system, notably the Canada Pension Plan, is adequately funded because the baby boomers will be "placing substantial financial stress on the entire pension system."

But companies, facing labor shortages, may find more healthy seniors ready to take on part-time jobs while community groups providing services to the elderly may find retirees ready to help.

And smart universities, Wigdor and Foot argue, will capitalize on an ageing society by adjusting their activities to attract older Canadians seeking retraining or pleasure.

Businesses will be able to plan for different opportunities — an older society means more wine and less beer, more chicken and fish and less beef, more theatre and movies and less professional sport, more travel and more demand for financial services.

The range of social, economic and even political effects of an ageing society are huge. By calling on us to think about these issues now, Wigdor and Foot are reminding us that, with planning, we can have a better future. And that's worth thinking about.

ONTARIO'S ENERGY CHOICES -
CHANGING NEEDS, CHANGING SOURCES

Presented by

James A. Hughes
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ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

This session is about Ontario's energy needs for the future and how they're changing. I want to look at that question from two perspectives - the changing mix of the basic fuels supplying Ontario's energy and the potentially changing sources of supply of some of those fuels.

A consistent theme of my remarks will be that, while we're focussing on Ontario, Ontario is, in many instances only part of larger energy markets. This is particularly so in the continuing environment of energy market deregulation. This policy environment reflects increasing confidence in the effectiveness of efficient market operations as the best long run managers of energy development, production and consumption. Therefore, Ontario's energy future concerns as much the evolution of the larger energy markets of which Ontario is a part.

World Oil Prices

Any discussion of energy futures should probably begin with some comments on the prospects for oil prices. Unfortunately today the only thing that one can say with certainty about future oil prices is their uncertainty. Recent events have powerfully demonstrated to energy forecasters the truth of the adage that: "He who would live by the crystal ball must learn to eat ground glass."

Nevertheless, a few key facts apply. World demand for oil, after declining significantly in the first half of this decade because of fuel substitution and increased efficiency, is once again growing. And while oil production in many parts of the world is proving very resilient to low oil prices, production from well-established areas like the U.S. is declining. More significantly for the longer term, new oil field discoveries are not keeping pace with demand and so the world continues to consume more oil than it finds.

Certainly the world's requirement for oil from OPEC has been increasing and should continue to do so. In time, OPEC will increasingly regain some of its price controlling ability.

Together, these create at least the potential for prices to rise well above current levels again, certainly to levels at which some of Canada's higher cost crude oil supply options become attractive. The question is not so much one of whether or not prices might rise significantly in real terms to allow their development but when.

This type of outlook is similar to one recently used by the National Energy Board in their latest Canadian energy demand and supply outlook. They considered a high price case with oil prices, in 1987 U.S. dollars, reaching $30 a barrel by the year 2000 and maintaining that level through 2005.

While we could see at least the potential for even higher prices within this time frame, the NEB's high case is a good representation of Canada's longer run energy potential and one on which I'll base many of my remarks.

Nevertheless, the timing of any price recoveries is probably its most uncertain component. Therefore prudent planning requires at least recognition of the contingencies presented by the NEB's low case which has prices only reaching $20 a barrel, as this may be more typical of the immediate market setting for several years.

Ontario Energy Demand

Consideration of the changing nature of energy resources supply to Ontario must begin by looking at the demand picture - what energy needs must be satisfied?

There the biggest change in recent years has been the displacement of oil in most of the stationery energy uses by natural gas and increasingly electricity. This has been a trend in Canada generally but particularly in Ontario. Oil has moved from being a basic commodity to meet all types of energy needs to being a premium fuel in markets like transportation where its special properties of being a liquid with easy handling properties and a high energy density give it a competitive edge.

In 1972, before the first oil price run-up, oil supplied half of Canadian residential energy - now only about 17%, and only 13% in Ontario. Its share of industrial energy over the same period has gone from 31% to 13% and 9% in Ontario.

Oil is unlikely to recapture much of the residential, commercial and industrial markets it lost. Gas and electricity will likely prove to be too strong competitors. However, having lost these markets, oil demand is now in a position to start recovering again, driven by growth in its primary markets - transportation and non-energy uses.

Gasoline prices in Ontario have returned to near their long run average level in real terms. Expressed as a percentage of per capita disposable income, the Canadian consumer spends less now on gasoline than he has at any time since 1956. The car fleet continues to improve in efficiency but this is now more a result of older, less efficient vehicles retiring out of the fleet. Indications are that average new personal vehicle efficiencies are levelling off and so eventually will the overall fleet. Add an increased demand for driving associated with an growing economy and you get the potential for some oil demand growth again.

It's not that the engineers have stopped building cars to get more useful energy out of a litre of gasoline. Consumers once again appear to be choosing to take the fruits of the engineers' labours in the form of larger or more powerful cars for the same fuel cost.

The NEB outlooks recognize this potential with oil demand in Ontario, in the high case, projected to increase at about 1.3% annually.

In the longer run, the more interesting competition in the stationary or basic heating markets - residential, commercial and industrial fuels - will be between gas and electricity. One reason is price, as real prices of oil and gas increase. Electricity prices of course have been cost based in Ontario and, given a large embedded base of assets, may not even grow with inflation, depending on the rate of growth of new generating capacity.

The NEB, in developing their outlook, broke with this tradition and assumed that future electricity price increases would track inflation. Even with this assumption, the gap between electricity and gas prices is likely to narrow. For example, they project, in the high case, the relative differential between electricity and gas, per unit of energy in the residential sector in Ontario narrowing from 63% in 1988 to only 9% by 2005. In the industrial sector it goes from 180% to 23%.

This would seem to still give gas the edge. However electricity doesn't need to be the same price to be competitive. Some of its special attributes - the way it can be controlled precisely, the ease with which it can transport energy - give it a significant form premium over other sources in many applications, sufficient to overcome material price differentials.

In addition, technological development and new industrial process technologies continue to augment electricity's comparative advantage.

The final major energy market in Ontario is the generation of electricity itself. In most provinces of Canada one form of electricity generation tends to dominate: Hydro in Quebec, Manitoba and B.C.; coal in Alberta and Saskatchewan. Ontario of course, uses both along with its nuclear program to give it a very balanced mix of power sources. The same options remain available to it, in varying degrees as it expands its power system. In many ways, the choices of energy sources for future electric generation is the most fascinating question in the Ontario energy future. However there's a separate session dedicated to that question tomorrow.

The Canadian Oil Supply Outlook

Today, the principal source of oil supply to Ontario is conventionally produced crude oil from western Canada. This is one aspect of Ontario's energy situation most likely to change. The reason is that most of the major oil fields in Alberta now providing that supply were discovered in the 1940s, 50s and 60s and most are now in their inevitable decline. There are some new discoveries being added but these are not of sufficient size to replace the large fields now being drained.

Even in their high price case, the NEB project crude oil production from these sources declining from about 1400 kB/D today to less than 600 kB/D by 2005.

Fortunately Canada possesses the resource potential to more than make up that shortfall. The catch is that it's high cost and subject to long project lead times. This makes the Canadian crude oil supply outlook particularly sensitive to future crude oil prices and it is Ontario that could take a lot of that swing.

The important new sources of potential Canadian supply are the frontiers and the oil sands. However, frontier supplies from east coast developments like Hibernia, while obviously an important new Canadian source to Atlantic refiners, are unlikely to make a significant contribution to Ontario.

The most important new component to future western Canadian and Ontario oil supply will be the oil sands - Canada's real oil ace in the hole. These represent one of the three truly great oil deposits in the world, the others being in the Middle East and the Orinoco tar sands in Venezuela. It's estimated that there are well over one trillion barrels of oil in place in the Canadian oil sands. We don't know how much of that will ultimately be proven recoverable but we do know we've only started to realize their potential.

That process of realizing the oil sands potential has taken two general approaches. One is the technique used at the existing Suncor and Syncrude plants and planned for the OSLO project where oil sands lying nearer the surface are mined with conventional surface mining methods and the bitumen extracted from the sand in an extraction plant. The other is in-situ production typified by our developments at Cold Lake where steam injection is used to allow heavy bitumen from the reservoir to be produced from conventionally drilled wells.

Once the bitumen is at the surface two problems remain. One is that bitumen is extremely viscous and difficult to transport. The other is that the Canadian refining industry has only limited capacity to handle bitumen as a feedstock. One market is asphalt production but demand is limited and seasonal. Otherwise extensive chemical conversion of the heavy bitumen molecules is required to produce products like gasoline and diesel fuel. Most of the available conversion capacity within Ontario is already using this or similar material. As producers have to go farther afield in search of additional markets, netbacks at the wellhead decline. It becomes appropriate to consider building upgrading capacity nearer the producing field to convert bitumen to either synthetic crudes or finished products.

Mining projects already include integral upgraders and as in-situ production expands further upgraders will be increasingly important components of energy industry investment. The difficulty, as mentioned, is cost. The NEB estimates that a new integrated oil sands mining plant would require an oil price of between $23 and $30, in real terms, to cover all costs and provide the producer with an adequate return on his investment. An in-situ project with an upgrader could require $21 to $28.

These prices are above current levels which mean oil prices have to increase if any of these projects are to happen. But they are all below the NEB's high price case, which means there is a good chance we will see the right price in the reasonable future.

The question is not if, but when.

As an illustration of the potential of these sources the NEB's high price case outlook includes three new integrated mining projects and two new upgraders for in-situ production. The resources are there to support even more projects but ultimately the constraints become reasonable construction capacity, local infrastructure, concerns over overheating of the local economy and the like. Certainly, this type of supply outlook along with frontier production maintains Canada's position as a net crude oil exporter through the outlook period. Net exports of crude and equivalent could be over 400 kB/D by 2005.

If, of course, world oil price increases are slower to materialize, then development of these sources will likely be delayed. Canada could revert, at least temporarily, to a net crude oil importer position. As an example, with the NEB's low case under which the requisite prices are never realized during the outlook period, net imports of refinery feedstock could grow to about 350 kB/D by 2005.

The implications for Ontario are straightforward. In the high case, Ontario refiners have at least the options of continuing to rely largely on Canadian crude supplies. In the low case however, they would probably find themselves competing with Quebec and western refiners for diminishing supplies of Canadian crudes. Increasingly they could be expected to turn to imported crudes and the NEB outlook would have imported crude in the low case supplying some 150 kB/D or just under 30% of Ontario's crude oil requirements by 2005.

These projections raise the question of security of oil supply for Canada and Ontario and potential exposure to the risks of supply curtailment and price shocks.

A few points help keep this issue in perspective:

- Canadian oil production declines and Canadian refiners turn increasingly to imported supplies only because of low prices. But prices will be low only if there are ample supplies from a wide variety of sources available and trading freely in world markets. In such circumstances it is difficult for one or few producers to control supply or price.

- The Canadian economy, and Ontario's as a representative portion of it, remains less dependent on oil and much less dependent on imported oil than the economies of most of our major trading partners. Our most significant exposure to international oil supply disruptions is the exposure of our economy to the effects on the economies of those trading partners. No degree of Canadian self-sufficiency protects against that risk.

- Oil is an international commodity, internationally priced. The risk of price shocks is an international risk beyond Canada's ability to affect. Only some kind of administered price scheme offers an insulation from this risk and that can be only partially effective. However, the inefficiencies and drawbacks of such schemes we know all too well.

For these reasons, we continue to believe that supply security is ultimately an international issue and one best addressed through international cooperation.

However, if a decline in the availability of Canadian crude oil supply is expected, even on a temporary basis, it is very relevant for Ontario to consider how it can arrange to obtain adequate supplies.

Crude Oil Supply Systems to Ontario

Today, the main system supplying crude oil to Ontario refineries is, of course, the Interprovincial Pipeline originating in Edmonton. The southern leg of this system, as it rounds the southern end of Lake Michigan, passes through the Chicago area, on its way up to Sarnia, Nanticoke, Toronto and on to Montreal.

The Chicago area is also a focus for a number of U.S. pipeline systems supplying U.S. crudes from Texas, Oklahoma, Louisiana and other producing states and increasingly offshore imports from the Gulf Coast ports.

Most of the many pipeline systems bringing this supply to the area converge on Chicago, making this a competitive focus for crude oil, and giving Chicago area refiners a wide variety of crude alternatives. This is a major reason why parity with U.S. crudes landed in Chicago is a basic market pricing mechanism for Canadian crude oils.

The Interprovincial link from Chicago to Sarnia offers the same supply flexibility to Ontario refiners. This potential came closer to realization with the completion in late 1987 of a connection in Mokeena, Illinois outside Chicago between Interprovincial and the Chicap system, part of the main Capline system coming up from Louisiana.

Today the Ontario refiner, with this connection, can have essentially the same crude supply options as other refiners in the northern Midwest. Right now that promises more flexible crude supplies to Ontario. In the long run, if Canadian crude oil production should decline in the face of continuing low prices, it offers a means of access to U.S. and offshore imports to make up any shortfalls on the same terms as many of the U.S. refineries with whom Ontario refiners now compete.

There would likely have to be further modifications upstream to add capacity in these systems. The U.S. oil industry is looking at a similar outlook to that in Canada - declining conventional production and rising domestic demand, but without a significant new source like the oil sands. This implies a downloading of the pipelines intended to move domestic production from areas like central Texas to Chicago and greater call on the lines, such as the Capline system from Gulf ports which can bring in offshore imports.

However some rationalization of that system is already occurring. One line, which used to move crude from Cushing Oklahoma to refineries on the Gulf Coast, has recently been reversed to take imports north from the coast to Cushing where they can be transferred to the system of lines extending up to Chicago.

Product Supply to Ontario

So far, I've been talking about the adequacy of crude oil supply to Ontario and how that might be maintained. However, no one, with the exception of the refining industry, really cares about crude oil. People want gasoline to run cars; diesel fuel to run trucks and heavy equipment, heating oil for furnaces and boilers, jet fuel for aircraft. In short, they want refined products and it is as demand for refined product that oil demand manifests itself. If we're concerned about adequacy of oil supply, what we're really concerned with must be the adequacy of refined product supply.

And when we look at the product supply picture for Ontario, we get a somewhat different and perhaps even richer picture than with crude oil.

The principal sources of refined product supply for Ontario today are the seven refineries now operating in the province. The estimates we've been discussing so far for demand for crude oil have been estimates of demand for these refineries.

With growing demand, the call on the refining industry will naturally increase. By 2005, the NEB estimates that refining capacity in Canada will be short of product requirement and Canada could be importing about 300 thousand barrels a day of refined products in both cases. Ontario would be receiving about a net 125 thousand barrels of product a day over refinery production in the form of transfers from other provinces and net imports in the high case.

This assumes no increase in refining capacity, which may or may not be valid. If this demand increase is realized on a long term sustainable basis, I would like to think that the Canadian refining industry, including that based in Ontario, is capable of expanding to meet that demand, and of doing so in a competitive, environmentally safe manner.

However, that may not be strictly necessary. Even as demand grows, the refining industry in Ontario will face continuing competition from other sources of supply.

In addition to local refinery production, Ontario today receives refined product supply from and trades with Manitoba and Quebec and imports, via truck and the Great Lakes, from midwest U.S. refiners, from Europe via the Seaway and from the U.S. east coast via product pipelines into the Buffalo area.

Growing oil demand offers better prospects for the refining industry in Ontario, but only if it can meet the challenge of continuing competition from all of these sources, competition which in the long run should continue to assure adequate and competitively priced supplies of petroleum products to Ontario generally.

Natural Gas

Finally, I'd like to talk a little about the future of natural gas supply to Ontario. As I mentioned earlier when discussing demand, natural gas has become the major fuel in the main stationary energy markets in Ontario, outside electricity generation. And it should hold that position in the future, subject only to increasing competition from electricity in the longer run. This, along with the greater difficulty relative to oil, in arranging alternate sources of gas supply makes the obtaining of suitable gas supply a matter requiring greater forethought and planning.

Fortunately, the long run gas supply picture for Canada is not as sensitive as the oil outlook to the major uncertainties surrounding world oil prices. In contrast to oil, future gas supply is not dependent upon a relatively small number of large, high cost projects.

There is still considerable potential for adding to Canada's gas production from conventional reserves in the Southern Basin. Add to that the potential from the frontiers and you have a very encouraging picture for Canada's natural gas industry.

This is indicated by the NEB's outlooks. They show Canada with sufficient gas production to meet all Canadian requirements and to provide about 1.4 trillion cubic feet of gas exports annually through the outlook period in both the high and low price cases.

This is a different picture than that presented in the 1986 outlook. Then projected Canadian natural gas production looked unlikely to be capable of even meeting Canadian demand towards the end of the outlook period. Of course supply and demand crossovers of that type do not occur in practice, provided markets are allowed to operate freely. Markets adjust. The more recent outlook incorporates a more thorough analysis of just how markets might indeed adjust and so the two different outlooks are not strictly comparable.

Nevertheless the prospects for the natural gas industry are brighter. That's partly an industry response to the opportunities presented by a more deregulated gas industry.

A less regulated environment for the natural gas business has meant both more competitive gas supply sources for major gas users here in Ontario and more incentive and market opportunities to encourage producers to develop new supply.

But with deregulation and the greater autonomy and choice it offers both users and producers must come responsibility. The producer must accept greater responsibility in seeking out his own markets, recognizing that deregulation brings more aggressive competition. The buyer must accept greater responsibility, in his gas supply contracting arrangements, for getting that mix of gas price and supply security that best suits his needs.

The result, as recent experience demonstrates, is a more competitive, more efficient and more productive gas industry. And that, in the long run, is the best assurance of real security.

Conclusion

The major conclusion to be drawn from this review is that Ontario is and should continue to be well-positioned to enjoy a diversified, competitive set of energy options. Canada today is unique as a significant, relative to its own requirements, net exporter of all major energy forms - oil, gas, coal, electricity and uranium. It has the potential to continue to be so through the foreseeable future. A possible exception is oil, but only in circumstances where a general ready availability of oil supplies internationally keeps oil prices down and temporarily delays development of what ultimately could be a vast potential. Admittedly most of these resources are not in Ontario, but positioned where it is in the Canadian and North American energy markets, Ontario will have competitive access to all these opportunities.

The key to the development of this potential will always be a supportive, stable policy setting, one which recognizes the primary of market forces, international market forces, as managers of energy demand and supply, and one which is committed to the economic development of Canada's resource potential.

REMARKS FOR PANEL DISCUSSION

"NATURAL GAS IMPACT ON ENERGY MARKETS"

ONTARIO'S ENERGY CHOICES CONFERENCE

Delivered Copy

Stephen T. Bellringer
President
Union Gas Limited
Toronto, Ontario
April 4, 1989

Good morning ladies and gentlemen, and fellow panelists. When I was preparing for this presentation I noticed in the program a very concise description of the Ontario Ministry of Energy's mandate - "to ensure that Ontario has energy supplies that are *secure*, *affordable* and *environmentally sound*. And it struck me how aptly these adjectives described the qualities that make natural gas such a important energy source today - accounting for about a *34* percent market share of total energy demand in Ontario in 1988.

I would suggest to you that the continued future success of natural gas in the market place will depend on just how well the gas industry can adapt to a changing energy business to ensure that supplies remain *secure*, prices *affordable* and that the *environmental advantages* of natural gas are well understood.

For the present, a booming economy in Ontario plus lower prices resulting from deregulation have contributed to increased demand for natural gas in the province - up about 10 percent in 1988 over the previous year.

This increase in the use of gas has brought many benefits to the Ontario market. In Union's area alone, customers are saving over $100 million per year. Some individual large volume industrial users have received savings of several million dollars. Lower energy costs help keep down production costs, strengthening the competitive edge of Canadian industry.

Homeowners, too, have seen several price decreases and regular rate natural gas is currently 6 percent cheaper than it was in 1983. And while it is true that we have not been entirely successful in our efforts to make truly market priced gas available to the majority of our customers, prices have dropped in real terms, defying even the inflation rate. This fact has undoubtedly encouraged homeowners to see natural gas as *the* energy source of choice. In what is often termed a "mature" business, we have experienced greater customer growth in the past three years than at any other time in our Company's history. I know other utilities have seen comparable growth. In addition, Union and the other Ontario utilities have signed new long-term contracts with Western Gas Marketing Limited. If approved by the Ontario Energy Board, these contracts will guarantee 12 more years of secure supply for our customers and price stability to 1990.

Another benefit relates to the need to expand our transmission facilities required to supply the growth in both sales, and transportation and storage markets. Millions of dollars have flowed into the Ontario economy for steel pipe, equipment and construction services. At Union, last year we invested more than $200 million to expand our storage, transmission and distribution facilities to meet growing demand.

The increased use of natural gas has another important benefit - a cleaner environment. As a sulphur-free fuel, natural gas does not contribute to the acid rain problem and therefore reduces pollution when it either replaces or is combined with coal in thermo-generation processes. Of all the fossil fuels it produces the least carbon dioxide or "greenhouse gas" during combustion. These qualities plus competitive pricing have increased the attractiveness of gas-fired co-generation and combined cycle technologies for the simultaneous production of steam for heat, and electricity. It was recently reported that by the year 2000, 45,000 megawatts of electricity will be produced this way by utilities in the United States.

And it is worth noting that natural gas is a highly efficient energy source in terms of the total energy available from the wellhead to the burner-tip. Virtually all the gas that leaves the ground is available for use compared with the conventional thermo-generation of electricity which leaves only 35 percent of the original energy available for distribution to markets.

In this context, even a conventional natural gas furnace with end use efficiency of 63 percent conserves more overall energy than a 100 percent efficient electric heating system. The high efficiency gas furnace significantly enhances this overall source to end-use efficiency equation.

In the vehicle fuel market, natural gas continues to make advances as a clean-burning alternative to gasoline at approximately one-half the cost. In Union's franchise area alone there are 20 NGV refueling stations and over 3,000 vehicles running on natural gas systems, including a number of buses particularly in the City of Hamilton.

Thus, the move to market sensitive pricing and greater choice in the buying and selling of gas have brought many benefits, economic and environmental, which in turn encourage greater market opportunities. However, success sometimes brings its own problems, and I would like to suggest that a number of critical issues must be addressed if this positive outlook for natural gas is to be maintained.

These issues revolve around the security of natural gas supply - both in terms of the contracts necessary to ensure adequacy of the supply and the availability of adequate facilities to ensure the timely delivery of that supply.

Firstly, the delivery system. The growth in domestic demand for natural gas resulting from deregulation has put pressure on delivery systems. The dramatic increase in exports to the U.S. - up 28 percent to 1.3 TCF in 1988 - has added to this strain.

The market-based regime has also brought customers a greater menu of choice for their gas purchase arrangements, which means a greatly fragmented market and less centralized gas purchasing. About one half of all Union's distribution volumes are moved by direct purchase arrangements, and these involve approximately 6,000 separate direct purchase delivery points. It is more difficult for a gas transporter to take a comprehensive long view of supply planning on behalf of all of its customers - a system which allowed for flexibility in problem solving and the maximization of resources. The customers have assumed the role and the risk of making their own supply, delivery and back-up arrangements. This growing number of options will undoubtedly require an expanded delivery infrastructure to accommodate individual needs.

And while expansions of our transmission systems are underway, I feel it is critical to optimize the potential of all facilities through co-operative ventures, and interconnections between existing systems. In this way Canada can expand system capacity, and increase deliverability while minimizing the costs to our customers. These are the inherent activities of a utility and the premise for the need for regulation. The high cost of an all-out building spree will have the effect of hiking rates, and ultimately rendering natural gas a less competitive energy source.

Co-operative ventures can also present opportunities for alternate sources of supply - which further increases security.

While Union Gas thoroughly supports direct purchase; and while we are financially neutral in the transaction, we have long been concerned about the risks of supply failure to these customers. There is a need for some form of a "customer security blanket" to help prevent supply interruption to municipalities or critical customers in the event that their direct purchase or brokered gas does not arrive on some cold winter night.

We agree with the OEB's report on gas supply security which confirms the customers right to contract for gas at the lowest price. However, we feel we must have plans in place to protect these priority customers should an unforeseen interruption occur. One serious interruption at a critical time could erode confidence in our product, the deregulated market system, and its benefits to the industry, the customer and Canada.

The OEB's recommendation of minimum three-year contracts for direct purchase customers as a means of protecting their supply is a significant improvement and will facilitate planning, including the arrangements for customer reversion to system gas when necessary. However from a practical point of view, East and

West, producer and consumer, must come to a meeting of minds on this important issue.

Also, the fact that the price gap is narrowing between direct purchase and system gas as spot prices rise, may leave some smaller volume users wondering whether the minimal savings warrant the risk.

Finally, there is the issue of the need for a long term approach to supply management with regard to both export and domestic demand.

Exports have risen dramatically in the past year to 1.3 TCF and are expected to reach 2 TCF -the equivalent of domestic demand. Exports provide a much needed stimulus to exploration and production, but at the same time we are dealing with a non-renewable resource which must be carefully managed in order to safeguard Canadian supply.

Long term contract commitments for domestic users will, in many ways, provide the key for supply planning for buyers and sellers alike. With long term commitments, proper planning can also take place to match facilities expansion with future demand.

In summary, it is my view that the strong position of natural gas in Ontario's energy markets can be maintained and even strengthened if we take a long-term approach to our supplies, contracts, facilities requirements and pricing. We will then succeed in perfecting a workable, competitive marketplace, capable of providing our customers with a secure, affordable and environmentally sound energy source for many years to come.

SESSION I TOPIC: NATURAL GAS IMPACT ON ENERGY MARKETS

Presented by

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ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

Mr. Chairman, Ladies and Gentlemen - Good Morning.

Before starting, I should note that IGUA is a voluntary association of industrial firms buying gas in Ontario, Québec and Manitoba.

We presently have 65 members in the pulp & paper, iron & steel; mining, smelting and refining; chemical and other industrial sectors. Our members represent between 60-90+ % of gas consumption in these sectors except for the "Other" category.

Outline

I would like to divide my presentation into three parts:

(A) - the current environment for oil and gas
(B) - three current issues - WGML/LDC contracts
 - SGRs
 - WACOG
(C) - two issues for the future - pipeline space
 - exports.

(A) Current Environment for Oil & Gas

If there's one word that best describes the oil and gas environment today, it has to be "uncertainty".

There are major changes taking place and this resultant uncertainty means that industrial gas users must keep their powder dry - meaning, do not commit to a single scenario; keep as many options open as possible.

Dr. Yergin (President, Cambridge Energy Research Associates) said yesterday that US $12-22/bbl. oil will likely prevail for the next several years.

He also noted that the upward price blips are relatively short and the downward flips much longer. This is borne out by the NEB plot of Annual Average U.S. Crude Oil Wellhead Prices where the very long term trend line has been flat at about $10 in 1986 U.S. dollars and may be heading there again.

Why do I say may be heading there again? Well, the U.S. Secretary of Energy, Mr. John Herrington, is quoted in the January issue of Manhattan, Inc. magazine as forecasting a price as low as $8 when, as a result of recession, global demand for energy begins to fall in absolute terms for the first time since 1982.

Turning closer to home, Dr. Yergin's "Natural Gas Trends 1988-89 Edition" shows the following changes in Alberta's export and domestic pricing from November/86 (the start of the market-sensitive pricing regime following the transitional year after the signing of the Agreement on Natural Gas Markets and Prices):

U.S. $/MMBtus - Alberta Border Price*

	Export	Domestic	Differences
Nov./86	1.82	1.59	0.23
Apr./88	1.62	1.56	0.06
Reduction	0.20	0.03	

* weighted averages of long- and short-term sales at then current exchange rates

We see a closing between domestic and export pricing as Canadian pricing increasingly is set by the U.S. marketplace.

This is to be expected under the Free Trade Agreement. IGUA has supported these policy changes before the NEB, provided that Canadian industrial users obtain gas prices which are competitive with those obtained by their U.S. competitors.

(B) Some Current Issues

- WGML/LDC Contracts -

Contrary to what some people have been asking me, IGUA is not in favour of rejecting these contracts. We recognize many of the criticisms of the OEB staff set out in their Argument but we do not come to the same conclusion.

We have said to the Board that if it can judge that the contracts further the intent of the Agreement on Natural Gas Markets and Prices, then despite the warts of which there are several, the contracts should be approved.

If their reservations are strong, the contracts could be approved for some shorter term but should not be rejected outright. We believe the producer/consumer, Alberta/Ontario relationships are too fragile for an outright rejection and would therefore be counter-productive.

- SGRs (System Gas Resale) -

Again contrary to what some people have been asking me, IGUA is not in favour of eliminating SGRs. In fact, we think they are an excellent option and obviously an attractive one to a considerable number of our members.

What we do say is that they are discriminatory in that they are available to only one supplier - WGML. We have argued before the NEB that SGRs are essentially transportation contracts and not sales contracts and that the Board should order TCPL to make this option available to all suppliers.

- WACOG (Weighted Average Cost of Gas) -

When the OEB ordered the Ontario LDCs to use WACOG for the LDCs' non-system gas buy/sells, it had what we believe was the unintended effect of generating an advantage for system gas. For example, system gas SGRs at $2.20/GJ (the Block B price) versus a WACOG of $2.07 for Consumers Gas generates a 13¢/GJ lower delivered cost to the SGR customer. IGUA sees this as essentially a transportation subsidy. The non-system supplier has to absorb this difference to be competitive at the burner tip. However, we believe from our cross-examination of WGML's witnesses that they will soon compete with the same burner tip price as that from non-system suppliers, thereby flowing this 13¢ back to the system producers.

IGUA's principle here is "reasonable equivalence" between system gas and non-system gas and we have proposed several options to the Board. It is hard for us to imagine that the Board will approve such a discriminatory situation.

(C) Some Issues for the Future

- Pipeline Space -

IGUA sees non-discriminatory access to pipeline space and control of that space as being more critical than the availability of gas over the next several years. Producers seem to be more optimistic that the perennial U.S. gas bubble is soon to disappear and have suggested to us that we should start thinking seriously of signing longer-term contracts.

It should be recognized that industrial users seldom have a supply contract horizon greater than five years, unless it is a green field site which might require longer contracts to secure financing. Experience has shown that it is dangerous to commit further down the road than this. Mr. Lee (Executive Director, Energy and Environmental Policy Centre, Harvard University) spoke to that yesterday in the context of planning by power utilities in New England. There are too many unknowns.

Similarly and for the same reasons, industrial users cannot assume long-term space commitments, given the prohibitive take-or-pay obligations. There are no regulatory authorities or governments which can force our customers to swallow our version of TOPGAS costs. Welcome to the free market!

Therefore, we need the type of decisions that the NEB issued last year:

- renewal rights on firm service contracts;
- bumping of short-term shippers eliminated;
- a queuing process initiated.

With respect to queuing - we suggest to TCPL that they do what they proposed to do - first come first served.

IGUA will be intervening in the upcoming TCPL 1990 GH-1-89 facilities hearing. We wish to keep an open mind on the issues, but we are disturbed by the cost increases flowing to domestic users for an expansion largely to serve export markets (436.3 MMCFD out of 532.0 or 82%):

Year Ending	Eastern Zone Toll	
Oct. 31/89	$0.79/GJ (excluding fuel)	
90	0.75	
91	0.88	
92	0.87	(+10.1%)

IGUA has previously argued before the NEB, unsuccessfully, that the Board should go back to TCPL's first rate case and allocate all subsequent investments between the two markets served to ensure that domestic users are not subsidizing export users.

I believe it's time that our proposal should be reconsidered by the Board. In the April 3rd issue of Forbes magazine in an article titled "Back from the dead", Mr. Maier, President of TCPL, is quoted as follows:

> "Our rate base - now C$2.5 billion - could well double within four or five years, and if you double the rate base, that should equate to a doubling in earnings, more or less."

That investment is quoted as increasing TCPL's capacity by nearly 350 Bcf/year or 26%. It can readily be appreciated what those rolled-in costs will mean for domestic users when over 80% of this new capacity is reported as committed to the U.S. market.

We agree that Canadian gas producers need improved access to U.S. markets but these export markets should not be subsidized by means of the traditional rolled-in cost methodology. Required - new policies for new times.

- Exports -

My final issue deals with the current Complaints Procedure adopted by the NEB in July/87 (in conjunction with the Export Impact Assessment and Public Interest Determination procedures). We note that the Board called attention to the fact that in the ProGas and Dome applications no complaints were filed.

IGUA has filed an intervention in the Esso/Shell/Gulf Mackenzie Delta application GH-10-88. Several days ago IGUA received an information request from the Board dated March 29th and to file our response to the following questions by April 7th:

Request: (i) In your view, will Delta gas supplies be needed in your Canadian market in the 20-year period commencing 1 November 1996?

(ii): Could you give the Board a rough estimate, by year, of the Delta volumes that will be required in your domestic market?

(iii): Have you had any discussions with the Applicants about the possibility of purchasing Mackenzie Delta supplies?

(iv): If yes, could you please tell us the nature of the discussions, particularly as they relate to the availability of Delta supply for your company?

If no, do you expect to have discussions and, if so, when?

(v): Would you be prepared to enter into a Precedent Agreement with the Applicants, to be followed by an executed contract by 30 June 1990?

(vi): From the standpoint of securing future gas supplies to meet your domestic commitments, do you think that it would be necessary for the Board to include in any export licence a condition that would enable domestic buyers to negotiate future purchase arrangements for Delta Gas?

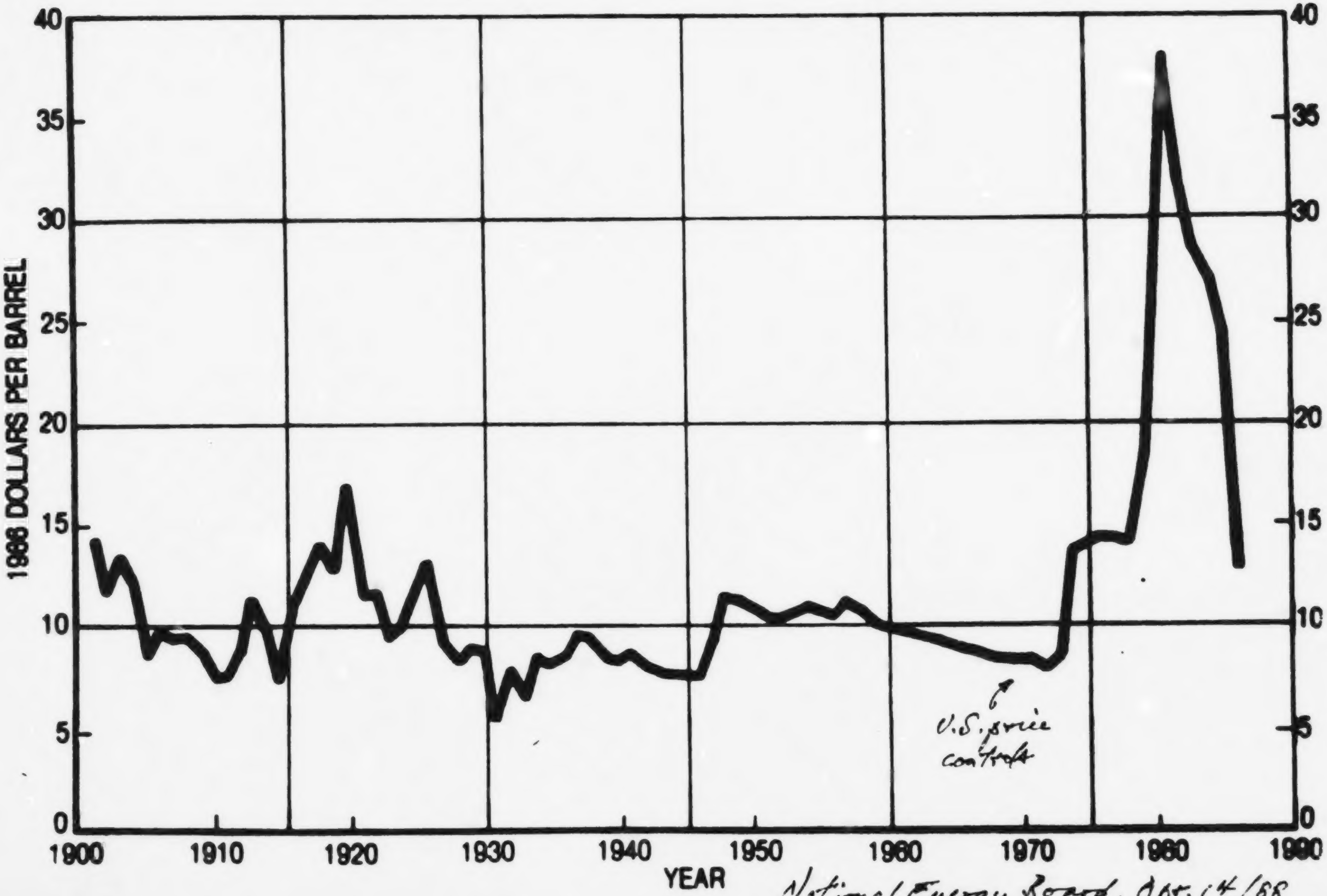
(vii): If yes, what specific criteria should be included in such a condition?

Now, may I ask, what kind of an information request is this?

I don't know what individual IGUA members think because I haven't heard back from any of them yet, but if this is the sort of situation individual Canadian gas users are going to have to face, then in my opinion the Complaints Procedure is not workable. The NEB will have to go back to the drawing board on this one.

And as a closing thought, should not export sales that do not have take-or-pay on the volumes be excluded from the application of the proportionality clause of the Free Trade Agreement?

Annual Average U.S. Crude Oil Wellhead Prices
(Constant 1986 $/barrel)



U.S. price controls

National Energy Board, Apr. 14/88

AS DELIVERED

NATURAL GAS IMPACT ON ENERGY MARKETS

REMARKS BY

DENNIS W. CORNELSON
VICE-PRESIDENT, MARKETING
AEC OIL AND GAS COMPANY

TO THE

ONTARIO ENERGY CHOICES CONFERENCE

APRIL 4, 1989

Good morning Ladies and Gentlemen. It is a pleasure to be here and to participate with so many distinguished speakers in this important dialogue on Ontario's energy choices. Speaking of choices, the sponsors appear to have made some wise ones. The choice of a theme for this conference is the essence of today's market based approach to energy policy. The choice of Tom Kierans to chair this conference is very appropriate. As the chairman of the Energy Options Advisory Committee that prepared the report entitled Energy and Canadians Into the 21st Century, he provides an important context for this focus on Ontario's energy options. If I may add a new twist to the much abused General Motors philosophy I can only assume the sponsors have concluded that, in this case, what's good for Canada is good for Ontario. Finally, I would like to express my appreciation for their choice of Paul Pinnington as moderator of this panel. Paul and I have had the opportunity to present our views on energy policy in a number of forums ranging from the sidewalks of Calgary to the Select Committee chambers of the Ontario legislature. I have learned that the Ontario Natural Gas Association is an important voice in making Ontario policy makers aware of our industry.

In thinking of choices, I am reminded of the story of the three American hunters that arrived in Alberta last fall on a duck hunting expedition. I believe they'd heard a rumor that the proportionality provisions of the Free Trade

Agreement also applied to ducks. They were informed that, as with Natural Gas, the Free Trade Agreement did not guarantee them anything and that they would have to go out there and compete. Being unfamiliar with the area they decided they'd better do a little investigation before they headed out into the country. They were advised it was the middle of hunting season and that many hunters were out after the same ducks. However, if they went to a certain location at the edge of a lake and set up a blind their chances should be pretty good. On the drive out the three decided that they should introduce a little competition to their day. The rules were simple; each hunter would be given exclusive rights to shoot during a 4 hour period but would only be allowed to fire one round of shells. The individual who shot the greatest number of ducks would be the winner. Well, they got out to the lake before dawn, set up their blind and awaited the ducks arrival. The three hunters were from New York, California and Texas. After drawing straws it was decided that the Californian would shoot first, the New Yorker second and the Texan last. The Texan was a little disgruntled about having to wait but he had the foresight to bring along a thermos full of his favorite spirits to help him while away the hours. In the meantime his more conservative friends from California and New York sat down with their coffee and waited for the ducks to arrive. The first duck arrived just after day break--a lone duck flying towards them over the horizon. The

Californian decided he would not take the first duck to come along. There would probably be a larger flock along soon given that it was early in the day. Unfortunately he was wrong. With all the other hunting going on in the area no other ducks appeared and he had to turn things over to his friend from New York. About half of his time had elapsed when another lone duck flew overhead. Having witnessed his friends experience and believing that a "bird in the hand is worth two in the bush" he grabbed his shotgun and fired, knocking the duck out of the sky. By the time the Texan came to shoot he'd had quite a few martinis. Being a Texan he was very confident that the biggest and best ducks were still over the horizon. His patience was finally rewarded when about an hour before dark another lone duck appeared on the horizon and flew towards the blind. He jumped up, grabbed his shotgun, took aim and fired. Unfortunately the martinis had taken their toll and the bird flew on, unscathed. The Texan lowered his gun in disbelief. "I can't believe it" he said "Normally I get two or three out of a flock like that". The moral of the story - when it comes to choosing the right duck, you can't afford to be overly optimistic about the timing or number of your alternatives.

While I have been specifically asked to address the impact of natural gas on energy markets from a producers perspective, I should point out that the company I represent, Alberta Energy Company, is also involved in the

PRODUCTION OF CRUDE OIL, COAL AND ELECTRICITY. WE ARE ALSO AN ENERGY CONSUMER SINCE WE USE ENERGY TO MANUFACTURE FOREST PRODUCTS AND PETROCHEMICALS. WE ARE ACTIVELY INVOLVED IN ENERGY TRANSPORTATION, BEING THE LARGEST CRUDE OIL PIPELINE OPERATOR IN ALBERTA AND INVOLVED IN SEVERAL PROJECTS FOR THE CONSTRUCTION OF NEW NATURAL GAS PIPELINES. WE HAVE BEEN VERY ACTIVE IN DEVELOPING CANADIAN AND U.S. MARKETS. AS ONE OF THE MAJOR SUPPLIERS OF GAS TO WESTERN GAS MARKETING AND AS HALF OWNER OF PAN ALBERTA GAS, WE HAVE HAD THE OPPORTUNITY TO PARTICIPATE IN MANY DIFFERENT FACETS OF THE EMERGING GAS INDUSTRY. SO MY COMMENTS WILL BE OFFERED FROM THIS BROADER PERSPECTIVE.

NATURAL GAS HAS BEEN AND CONTINUES TO BE AN EXCELLENT ENERGY CHOICE FOR ONTARIO. IT HAS FOR MANY YEARS BEEN A SECURE, RELIABLE, ATTRACTIVELY PRICED AND ENVIRONMENTALLY FRIENDLY ENERGY SOURCE PROVIDING THE SERVICES AND FEED STOCKS THAT ONTARIO RESIDENTS AND INDUSTRIES HAVE COME TO RELY UPON. I KNOW YOUR HISTORICALLY STRONG COMMITMENT TO NATURAL GAS REFLECTED THE VALUE YOU PLACE ON ENERGY SECURITY, THE ENVIRONMENT AND PRICE. I STRONGLY SUSPECT THAT THOSE VALUES HAVE NOT CHANGED. I AM CONFIDENT THAT, AS YOU INCREASINGLY LOOK TO MARKETS TO PROVIDE GUIDANCE IN THE PROPER ALLOCATION OF ENERGY RESOURCES, YOU WILL FIND NATURAL GAS WILL CONTINUE TO BE AN ATTRACTIVE OPTION.

THE ENERGY OPTIONS REPORT RECOGNIZES THE IMPORTANCE OF CONSISTENCY BETWEEN A COMPREHENSIVE ENERGY POLICY FRAMEWORK AND YOUR VALUES. IT ADMONISHES CANADIANS TO MAINTAIN THEIR

FIRM GRASP ON IMPORTANT VALUES, BECAUSE THEY ARE INTEGRAL NOT ONLY TO ENERGY POLICY BUT ALSO TO THE NATIONS CHARACTER. LET'S CONSIDER THE RELEVANCE OF THIS ADVICE FOR ONTARIO.

THE VALUE OF ENERGY SECURITY IS DEEPLY ROOTED IN THE CANADIAN PSYCHE. IT IS INSPIRED BY OUR NEED TO SURVIVE IN A ROUTINELY COLD AND HARSH CLIMATE AS WELL AS OUR DESIRE FOR SUSTAINABLE ECONOMIC DEVELOPMENT. I EXPERIENCED FIRST HAND DURING MY TIME WITH THE NATIONAL ENERGY BOARD IN THE EARLY 1970'S THE ANXIETY THAT CAN DEVELOP WHEN PLANNING AND PREPARATION HAS NOT BEEN DONE TO ALLOW A MEASURED RESPONSE BY PRODUCERS AND CONSUMERS TO ABRUPT CHANGES IN ENERGY MARKETS. UNFORTUNATELY THE POLICY REACTIONS OF THE DAY WERE BLUNT INTERVENTIONIST INSTRUMENTS WHICH CREATED ECONOMIC INEQUITIES, POLITICAL TENSIONS, AND AN INEFFICIENT RESPONSE TO CHANGING MARKET CONDITIONS.

WE HAVE NOW MOVED FROM THAT PERIOD OF PERCEIVED ENERGY CRISIS TO A PERIOD OF ENERGY SURPLUS. WE HAVE SHIFTED FROM FORMULAIC EXPORT CONTROLS TO MARKET BASED PROCEDURES AND THE FREE TRADE AGREEMENT. BUT WE ARE STILL FREQUENTLY REMINDED OF THE CONCERN THAT CANADIANS FEEL ABOUT THEIR ENERGY SECURITY. WE ARE FINDING THAT, WHILE THE 1970'S POLICY INSTRUMENTS WERE FLAWED, THE VALUES WHICH INSPIRED THEM WERE NOT. TODAY'S POLICY MAKERS AND THE ENERGY OPTIONS TASK FORCE DO NOT SUGGEST THAT WE REDUCE THE VALUE WE PLACE ON SECURITY, BUT THAT WE DEVELOP A POLICY FRAMEWORK THAT ENSURES THIS IMPORTANT VALUE IS EXPRESSED IN COMMERCIAL

COMMITMENTS WHICH ALLOW IT TO BE REFLECTED IN AND RESPONSIVE TO THE MARKETPLACE.

IN SPITE OF THE CONCERN EXPRESSED ABOUT THE GLOBAL WARMING TREND, WE CANNOT COUNT ON IT TO REDUCE OUR NEED FOR ENERGY TO KEEP US WARM DURING OUR COLD CANADIAN WINTERS. FOR QUITE A FEW YEARS CALGARY WAS LULLED INTO A FALSE SENSE OF SECURITY BECAUSE OF OUR UNUSUALLY MILD WINTERS. DURING LAST YEARS OLYMPICS, OUT-OF-TOWN VISITORS WERE SURPRISED TO FIND THAT CALGARY'S TEMPERATURES IN FEBRUARY CAN BE AS WARM AS MIAMI. THIS WINTER, HOWEVER, WE WERE FORCEFULLY BROUGHT BACK DOWN TO EARTH WHEN THE SIBERIAN EXPRESS ROLLED THROUGH TOWN IN EARLY FEBRUARY. THIS CREATED EXTREMELY HIGH REQUIREMENTS FOR NATURAL GAS FOR HEATING PURPOSES AND OUR GAS DISTRIBUTORS AND SUPPLIERS WERE REALLY SCRAMBLING TO MEET THE SURGE IN DEMAND. WE WERE REMINDED THAT ENERGY SECURITY FOR CANADIANS CAN BE A MATTER OF LIFE OR DEATH.

WITH THE PHENOMENAL GROWTH THAT THE ONTARIO ECONOMY HAS ENJOYED IN THE LAST FEW YEARS THE IMPORTANCE OF SUSTAINABLE ECONOMIC DEVELOPMENT IS OBVIOUS. OUR EXPERIENCE IN THE OIL INDUSTRY HAS DEMONSTRATED HOW PAINFUL INSTABILITIES IN ECONOMIC DEVELOPMENT CAN BE. IN AN INCREASINGLY COMPETITIVE ENVIRONMENT IT IS IMPORTANT TO DEVELOP INDUSTRIAL ALLIANCES THAT CAN EFFECTIVELY COMPETE FOR MARKETS. ONTARIO INDUSTRIES WILL BENEFIT IF THEY ALIGN THEMSELVES WITH CANADIAN GAS.

NATURAL GAS IS A LOGICAL CHOICE FROM THE PERSPECTIVE OF BOTH ENERGY SECURITY AND ECONOMIC DEVELOPMENT BECAUSE OF THE comparative advantage of our resource base. Currently proven discovered Canadian gas reserves have satisfied growing demand for natural gas in Canada and an increasing share of the U.S. market. We have the ability to further expand our natural gas production and to sustain it over the long term. In Western Canada alone as much gas remains to be discovered as has been discovered to date. More gas is available in the Arctic and East Coast regions. The U.S. also has substantial remaining resource potential. Given what we've learned about the resource base, I am confident that natural gas will continue to be a sustainable energy choice well into the 21st century.

Natural Gas will continue to be competitively priced. Finding and development costs are competitive and a large portion of its market has the ability to switch to alternative fuels. When these factors are considered in the context of the large remaining resource base you can be confidant that prices will remain competitive, provided they are market driven. I do not mean to suggest however, that natural gas prices can remain as low as they are today. As the temporary surplus that developed during the period of regulation is absorbed, we expect that we will see reasonable increases in natural gas prices to better reflect its value to consumers and the incentives necessary for exploration and development.

In making your policy choices you should bear in mind that your values are shared by others in many jurisdictions

IN NORTH AMERICA. THE DESIRE FOR ENERGY SECURITY, FOR SUSTAINABLE ECONOMIC DEVELOPMENT, AND CONCERN OVER THE ENVIRONMENT ARE PART OF OUR COMMON FUTURE. AS BUYERS AND THEIR REGULATORS IN QUEBEC CITY, NEW YORK, CALGARY, CHICAGO, WINNIPEG AND LOS ANGELES, EXPRESS THEIR ENERGY CHOICES IN THE MARKET, THEY WILL DO SO IN THE FORM OF CONTRACTUAL COMMITMENTS AND PRICE. IN THE UNITED STATES FOR EXAMPLE, MANY OF THE MAJOR DISTRIBUTION COMPANIES ARE FACING EXPIRING CONTRACTS IN THE EARLY 1990'S MAKING IT NECESSARY FOR THEM TO MAKE NEW GAS SUPPLY CHOICES. TO THE EXTENT THAT THEIR TRADITIONAL U.S. SUPPLY SOURCES ARE PERCEIVED TO BE LESS RELIABLE THAN COMPETITIVELY PRICED CANADIAN SUPPLIES THEY WILL DIVERSIFY TO INCLUDE CANADIAN GAS. EVIDENCE THAT MANY U.S. CUSTOMERS ARE ALREADY SHOPPING FOR NEW CANADIAN SUPPLIES IS APPARENT IN THE NUMEROUS PIPELINE EXPANSION PROPOSALS UNDER CONSIDERATION.

FORTUNATELY THE ONTARIO DISTRIBUTORS HAVE HAD A UNIQUE OPPORTUNITY TO OBTAIN LONG TERM SUPPLY COMMITMENTS FROM THEIR TRADITIONAL CANADIAN SOURCES BEFORE THIS ENHANCED COMPETITION FULLY DEVELOPS. PIPELINE EXPANSIONS TYPICALLY REQUIRE AT LEAST 15 YEARS OF COMMITTED PROVEN GAS SUPPLY AND FIRM MARKET COMMITMENTS. BY ENTERING INTO LONG TERM CONTRACTS NOW, THE DISTRIBUTORS HAVE REMOVED SUPPLY FROM THE MARKET SO IT IS NOT AVAILABLE TO UNDERPIN EXPANSION AND COMMITMENTS TO OTHER MARKETS. THEIR TIMING COULD NOT HAVE BEEN BETTER.

The Energy Options report stressed the importance of focusing on the long term because of the long lead times necessary for fundamental change. At the same time, it emphasized the importance of maintaining flexibility and adaptability in energy policy to accommodate change and uncertainty. The new long term contracts between Ontario distributors and Western Gas Marketing provide adequate lead time to adjust to change and are structured to respond to changing market conditions. If these contracts are backed up by a policy framework which reflects your traditional values, you will be in an excellent position to deal with the inevitable changes in energy markets including the growing competition from our U.S. friends.

In conclusion I hope that Ontario reaffirms the choice that they wisely made many years ago to promote the long term reliance of Ontario consumers on natural gas. If you approve the new distributor contracts we will be very close to a commercial and policy framework that upholds traditional Canadian values even with a more market based approach to energy policy. If we really do share common Canadian values, we should not find that achievement too surprising. Nor should we be surprised that the "bird in the hand theory" applies to more than just ducks.

Thank you.

RESPONDING TO ONTARIO'S CHANGING ENERGY NEEDS

Presented by

Art Douloff
Vice-President, Transportation,
TransCanada PipeLines Limited
Toronto, Ontario

ONTARIO'S ENERGY CHOICES CONFERENCE
April 3-4, 1989

<SLIDE 1> Ladies and gentlemen, fellow panelists. Good morning. I would like to thank the organizers of this conference for the opportunity to give a transporter's view on natural gas in the Ontario energy market.

It's a pleasure to be here representing a company that, for most of the past 30 years, has delivered one-third of Ontario's total energy requirement—a company proud of its record as a safe, efficient and reliable transporter of natural gas.

Whenever the words "energy" and "Ontario" are used in the same breath, the focus is usually on an energy need, and how it is being met—or how it could be better met. As Canada's largest consumer of energy, Ontario is in many respects an entity in search of a solution to its energy requirement.

<SLIDE 2> Today I'd like to talk about how TransCanada has answered Ontario's energy need over the years, and how our response has changed and continues to change with deregulation.

I'd like to touch on some of the things we are doing to ensure that our largest customer continues to be well served.

HISTORY

To put my remarks in context, let me first give you some background on TransCanada, our place in the natural gas industry, and how we benefit Ontario energy consumers.

TransCanada PipeLines was created in response to a public policy objective—to answer the need for secure, reliable supplies of natural gas in Canada's industrial heartland.

<SLIDE 3> TransCanada PipeLines is the sole Canadian transporter of Alberta natural gas destined for eastern Canada. Our pipeline stretches some 3 500 kilometres from Alberta to Montreal and includes over 10 000 kilometres of steel pipe and compression facilities, over half of which is located here in Ontario.

In addition to our mainline through Canada, we are 50 per cent owners of the Great Lakes Gas Transmission system. It operates as a large loop of our Canadian mainline, runs through Wisconsin, Minnesota and Michigan, and reconnects with our facilities near Sarnia, Ontario. We also have investments in other pipeline affiliates in Canada and the U.S..

For communities along the line, the employment spin-offs provided by TransCanada's system; the taxes it generates; and the strategic supply of competitively priced energy it supplies, all spell good economic news.

In addition, more than half of TransCanada's 2,000 employees live and work in Ontario, many of them at our corporate offices here in Toronto.

<SLIDE 4> We operate one of the world's longest pipelines. Last year, TransCanada delivered a record 1.35 trillion cubic feet of gas. A trillion of that was delivered to Canadian consumers with Ontario taking the largest portion by far, a total of 717 billion cubic feet.

And we moved it efficiently.

EXPANSION

Today, the energy link between Ontario and the natural gas fields of western Canada is strengthening with the major expansion of our pipeline system now taking place.

As many of you are aware, TransCanada has embarked on the first phase of a two-year construction program with planned expenditures of about $650 million in 1989. We've requested approval for a program of similar size in 1990, in conjunction with expenditures of more than U.S.$400 million on Great Lakes.

This year's program is the largest project we have undertaken in nearly a decade. It responds to growing demand for natural gas in eastern Canada and the United States. In Ontario alone we will spend some $450 million in 1989 to expand the pipeline's capacity.

<SLIDE 5> These expansions will enable us to increase our firm service deliveries by about 330 billion cubic feet annually or about 900 million cubic feet per day.

We project firm deliveries—these exclude interruptible service—will rise from about 1.36 trillion cubic feet in the current contract year, to 1.5 trillion cubic feet in 1989-90 and to 1.69 trillion cubic feet in the 1990-91 design year.

About 40 per cent of the new service we are adding this year is destined for Canadian markets, with Ontario consuming the lion's share.

About 15 percent of the new service associated with our 1990 facilities is dedicated to domestic markets.

<SLIDE 6> This expansion is taking place in a much different industry environment than that of just three years ago. Today, I'd like to give you a sense of how things have changed from a transporter's perspective.

Historically, TransCanada was the sole purchaser of gas for the Canadian market. We provided our customers with sales and transportation under single, bundled contracts. Price of the commodity was negotiated until the mid-70s when governments began a 10-year stint of administered gas pricing. Transportation rates have always been regulated recognizing that the country could afford only one transportation system.

Throughout this period the use of natural gas grew. Gas quickly took its place beside other energy sources to become a key component in developing and sustaining a strong, competitive industrial sector in eastern Canada.

DEREGULATION

<SLIDE 7> In 1985, the governments of Canada and the western provinces signed the Agreement on Natural Gas Markets and Prices and set the stage for deregulation. At the time, much was unknown about how a deregulated industry would function—the move to a market-driven industry was, in many ways, a leap of faith.

Considering that, deregulation has gone remarkably well.

As the major transporter of gas, TransCanada's face to the world may not be markedly different than it was three years ago. We continue to operate as a regulated utility. We continue to have our tolls fixed by the National Energy Board.

<SLIDE 8> However, I can tell you that beneath the calm exterior, we've been doing somersaults. There is no clearer sign of TransCanada's responsiveness to the changing environment than the huge increase in the number of the contracts we now have to transport natural gas.

Our customer base has exploded. At the end of February, we had some 850 transportation contracts with shippers. Four years ago, there were less than 50.

With the unbundling of sales and transportation services, pipeline capacity has itself become a commodity. People want to buy it. People want to sell it. People want to change its nature. People want more of it created in a hurry. And they want all of this, yesterday.

<SLIDE 9> This new view of capacity raised and continues to raise all sorts of questions. Who should get it? How should people queue up for it? Should third parties be allowed to broker it? Should people lose it if they don't use it? Under what conditions should new capacity be added?

These are difficult issues, reviewed in detail at our just-completed tolls hearing before the National Energy Board.

CUSTOMER SERVICE MEANS EFFICIENCY

What is TransCanada's framework for responding to this change in our market? What are the overriding considerations that help determine TransCanada's response to these sorts of issues?

The answer lies in TransCanada's responsibility to all system users—the company's mandate to run an efficient system, to keep costs to a minimum, while providing safe, reliable service.

In practice this means ensuring that the pipeline will not become underutilized and inefficient. I think in many of the issues that have arisen since 1985, our efforts to ensure efficient pipeline use are often mistaken for a reluctance to change.

TransCanada is an open access, contract carrier. We are not a common carrier. Our responsibility is to protect the investment in existing and new capacity.

We serve all our customers—our shippers in the west and the east—by ensuring that our system is fully utilized. And over the years we've established an excellent record in this area.

Our central section from Winnipeg to Toronto, for example, has operated at full capacity each day during the past four years. Great Lakes operated at capacity each day last year.

As a major transporter of energy to this province, the efficient use of our system is an energy issue for Ontario. If our system is underutilized, the consumer ultimately pays. If the system is used efficiently, the consumer ultimately saves.

<SLIDE 10> I think any energy consumer would be impressed by the trend in TransCanada's tolls over the past few years. In November, 1985, the charge for moving a gigajoule of natural gas to eastern Canada was 95 cents. Today, the charge is 76 cents. The substantial reductions we've achieved are largely attributable to increased throughput.

RESPONDING TO CHANGE

Within the framework I've just described, we've dramatically changed the way we do business. Probably the single most important change brought on by deregulation is the shift to shorter-term transportation arrangements.

New shippers and end users want transportation, but they are reluctanct to sign up for the long terms that were the industry standard between transmission companies and local distribution companies.

This desire for short term service applies to existing pipeline capacity, and colors all plans to add new pipeline capacity.

<SLIDE 11> TransCanada has responded to this shift. At the end of 1988, more than 25 per cent of domestic deliveries were moved under transportation contracts of three years or less.

Generally speaking, we will build capacity if we think the facilities will be used over the long term. In other words, we don't necessarily need a long-term contract for transportation, we just need to be sure that the market is long term, and will be served by our facilities.

The important question we must continue to grapple with is how to determine whether the underlying market is long term. I don't intend any disrespect to my friends on this panel, but the question becomes more complicated with the prospect of another delivery system emerging to serve the market with gas from the United States.

COOPERATION NEEDED

These issues are not simple. We know we don't have all the answers. We know we must work together with our customers to determine what's in the best interests of all users. And we know we must balance the desire for flexibilty and short term gain, with the need to recognize the rights of all system users.

<SLIDE 12> We also know we're making progress. We've worked hard to make it easier for buyers of transportation to understand the ins and outs of reserving pipeline capacity. We've made our contracts simpler. We've tried to standardize terms of service to make negotiations less complex. We've introduced queuing procedures that we believe are fair to all system users.

LEAD TIMES AND PLANNING

If I could send a message to customers today it would be a reminder that natural gas is not like other forms of energy. Because of the delivery system it requires, and the distances it must travel, users must come to terms with the need for advance planning when making transportation arrangements.

<SLIDE 13> At the moment, our system is operating at capacity. All existing and planned firm capacity is booked until November 1991.

Building new facilities is a complex and lengthy process. TransCanada requires in excess of two years to evaluate requests, plan optimal facility expansions, gain regulatory approval, order materials and install the facilities.

<SLIDE 14> For example, it generally takes 15 months lead time just to get compressors on site and up to three months more for installation and testing. Lead times are even longer when the industry has a number of similar projects underway at the same time, as is happening now.

The implication for gas supply planning is clear. The decisions and requests for service need to be made well in advance of the time when the gas is actually needed.

The situation is further complicated because we are now just coming out of a period of plentiful transportation and plentiful gas.

<SLIDE 15> Another consideration that end users may need to take into consideration in their transportation planning is the impact of Free Trade. For example, historically, Canadian customers had priority over U.S. customers for interruptible service. Now U.S. shippers will have equal access under Free Trade to interruptible supplies.

Currently, interruptible service accounts for less than two per cent of total throughput, about 25 and 35 billion cubic feet per year. With the increasing demand for gas in the United States, much of the capacity for interruptible service could be taken up by customers south of the border.

I've tried to show you that TransCanada's business has changed rapidly with deregulation, yet we strive for the efficiency that has made us a valued contributor to Ontario's energy solutions.

Let me point to one other clear illustration of our desire to meet the needs of a changing environment.

Innovative Projects

<SLIDE 16> My comments concern several innovative projects that involve using natural gas to generate electric power.

TransCanada has made a proposal to Ontario Hydro to use a combination of steam and gas turbines to generate electric power at the company's compressor station near Nipigon, Ontario, north of Thunder Bay.

Nipigon was chosen because local power demands are increasing, and it's a difficult area for Hydro to serve. The advantage of our solution is its short lead time compared to the alternatives—as little as two years. In addition, we can bring on the exact amount of capacity required to meet the need.

If our talks with Ontario Hydro proceed on schedule, work could begin on the Nipigon project this summer. Similar plants could be built elsewhere along the pipeline. Indeed, we're already looking at five or six sites.

<SLIDE 17> Gas-fired plants offer an economic and environmentally attractive alternative to coal and oil-fired power plants. They can also reduce the need for transmission rights-of-way from large base-load facilities.

These same factors apply to our joint proposal with Consumers Gas to redevelop the site of the mothballed, coal-fired Hearn plant in Toronto.

Our idea is to use natural gas in a combined cycle power plant. The site already has electric power transmission facilities, a gas pipeline connection, and a water cooling system. Its potential for 1,000 megawatts of power offers a low cost, realistic energy option for the province.

Overall, gas-fired power projects could add about 2,000 megawatts of power to Ontario's electric generating capacity in a relatively short time. While they will not provide a total answer to Ontario's energy needs, gas-fired plants could be part of the solution.

In our dealings with Ontario we've been able to draw on our experience with the Ocean State Power Project in Rhode Island, in which we hold a 40 per cent interest.

The gas-fired plant will more than double Rhode Island's current output of electricity. It will provide about two per cent of the total supply for New England Power, a multi-state electric system about the size of Ontario Hydro.

<SLIDE 18> While there is major potential to develop similar systems here in Ontario, the economics must be viable. For example, given its mandate, Ontario Hydro seeks to negotiate the lowest possible prices from independent power producers.

Unfortunately, many innovative projects are economically marginal at the rates offered by Hydro. Consequently few are built here compared to the United States, where rates provide developers with more economic incentives. I think more work needs to be done here in Ontario to offer independent energy developers financial incentives.

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I hope my comments this morning have sketched a picture of how TransCanada is responding to changes in the energy environment, and gave you a sense of how we are working to meet Ontario's changing energy needs.

I'll be happy to answer your questions.

CONSERVATION AND EFFICIENCY

Presented by

Don Buchan
Director
R-2000 Project
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Ottawa, Ontario

ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

I was asked to talk a little bit about energy conservation in the residential sector, and I am going to deal mainly with the R-2000 Program which deals with the new housing sector rather than the renovation area.

The R-2000 Program is a program as opposed to just technology. It's a program whose structure was put together specifically to deal with energy conservation in new housing but the concept of the program is very applicable to many other areas, including the retrofit area. It's this fundamental approach that's important, much more than the technology per se.

The R-2000 Program started out as an energy program, certainly its base is in energy conservation, but it's much more than that. We like to talk about it as a quality housing program for many reasons, not the least of which is you don't sell energy efficiency in the housing industry very well these days. It's very far down on people's list of priorities. Quality, comfortable housing is much higher on the priority list.

I'd like to review the history of the R-2000 Program and how it evolved. You could probably go back as far as 1978. People may remember something called Saskatchewan House which was built in 1978, the first of the super energy efficient houses built in Canada. It heated for something like twenty dollars per year. At about that time people started thinking about doing something on a much larger scale across Canada to promote this kind of housing. The name "R-2000 Program" actually was first used in 1982 to identify this particular program.

One of the most important parts of the R-2000 Program is the fact that it is a joint industry-government program, very heavily funded at the front end by the federal government and numerous other players. It was realized from the very beginning that if this program was going to be successful, it was going to have to be done through the established industry in Canada.

The program was given the time to develop to the stage that it's at now. We are really still in the early stages of the program if you want to look at it that way. It was more important that we came up with long-term results rather than very short-term results. And that's essential to a program of this sort.

The program has now developed to a point where it really is industry-driven, industry-run with a very small amount of government funding in the program relative to the early days. This was all part of the plan. As far as the funding arrangements go, the program is now basically where people wanted it to be when they started talking about this in 1982-1983. And this is a credit to a lot of people in a lot of different organizations that have been involved in this, not the least being the Canadian Home Builders' Association; Energy, Mines and Resources; and the Ontario Ministry of Energy.

It started out as a technology development exercise to a great degree. It was realized in those early days that energy conservation was what we were trying to do, but it had to be done in a very organized, package arrangement. When the technology was developed in the early days, the program was developed to encompass not only energy efficiency, but indoor air quality, comfort, and some of the other issues which were considered important. There were a number of other programs in existence at that time which had problems because they hadn't addressed some of the potential peripheral issues. In the R-2000 Program we tried from the very early days to see what some of the spin-off problems could be from the program, and addressed those as part of the package. Hence the R-2000 technical standards that exist today try to deal with all of those issues. We tried to end up with a program that didn't have any serious liability problems with it.

The second phase has been a very large training and education exercise. It was realized, again, that if we were going to deliver a program of this scale, we were going to have to deliver it through the industry which wasn't necessarily in a position to accept it, so training and education was extremely important. The magnitude of that exercise has been such that we now put something in excess of 12,000 people through the technical training program for the R-2000 training program known as the R-2000 Builder Workshop. The home building industry is an incredibly large organization when you look at all of the people and organizations involved -- all the regulatory people, the energy supply people, hydro, gas people, various others. It's a very large industry, and it requires not only builders understanding the technology but requires all these other people to understand the technology and work as a team in delivering an effort of this sort.

The third phase of the program, which is the one we're in now is in the marketing area. This is not to say that we're not still working on technology development and we're not still working on training and education. In order to have the impact we want, you must have the consumers aware of the program.

We have never intended that all houses in Canada be built to the R-2000 standard. What we did was set a relatively high standard for people to aim at, realizing subsequently that only a small percentage of houses would actually be built to the standard and subsequently registered as R-2000 houses. We want enough houses built and registered to give the focus of this as an important issue; however, the diffusion aspect of the program is in reality more important than the actual number of houses that we register.

Over the last year or so, we have spent some considerable effort determining what that diffusion benefit has been. And it has really been quite substantial. We can safely say now that to varying degrees there isn't a new house built in Canada that isn't positively affected by the efforts under the R-2000 Program. Some are to a much lesser degree than others. In the coming year will register in the order of 3,500 R-2000 houses. There will be close to ten times that number of houses built to something very close to the R-2000 standard and every other house built in Canada will have some benefit from the program.

What we're really trying to do is to raise the standard of housing in Canada, particularly in the area of energy, and we have done this through a training and education effort. We are trying to make the building industry aware of the issues rather than tell them how they have to do things. One of the most important aspects of the program is that it is a non-regulatory program. It is a voluntary program that tries to deal with the industry as it currently exists, not to try to reform the industry through a regulatory process. We have spent some effort at looking at the comparison between what has happened here and what has happened in a much more regulated environment, particularly in the U.S.. We are finding that we are certainly making gains in the energy efficiency area, which are equal to or better than the gains which are being made in very highly regulated environments in some states in the U.S.. We're making them in what we think is a much more positive fashion; that is, we're actually fundamentally changing the industry, where builders in Canada are much more aware of the issues and technology that they're dealing with. When you compare this to many cases where there has been a standard put in place to increase the energy efficiency in housing, you find that the industries are doing it, but aren't in many cases aware of why they're doing it, and they certainly don't understand what it is they're doing. They don't understand the technology and there are a lot more mistakes being made. Generally, one finds in those conditions the effect is much shorter in duration.

At this phase we're in a program that is heavily into the market end of its mandate. It is very heavily funded now by industry. Industry funding is in order of magnitude more than the government funding at this point. It comes from numerous organizations: utilities, private companies in the building supply business, developers, and various other organizations. It will be through this route that we will continue to be successful with the program. It's a program which has proven to be very successful for a number of organizations other than just the builders of the industry themselves. It allows a lot of other organizations to piggy-back efforts in the housing industry on the R-2000 Program.

The R-2000 Program has been particularly successful in Ontario because of the early efforts put in by the Ontario Ministry of Energy. They were one of the biggest supporters of the program in the early days, outside of the federal government, and they've continued to be so, in areas which I think have some real importance. Last week the presentations of this year's R-2000 student design challenge awards took place. It's a university/college competition where students are asked to design houses to the R-2000 standard and other criteria relating to good housing design, and it's very encouraging to see over the last few years both the improved quality and quantity of the contest submissions. This to me speaks very well for the future of the housing industry, seeing the people that are going to be in it actually taking this subject very seriously.

Speech to the Ontario's Energy Choices Conference:

THE CONSUMER AND ENERGY EFFICIENCY AND CONSERVATION

By Joan Huzar, Vice President, Issues and Policy, CAC (Ont)

I am very pleased to be here this morning to represent the Consumers' Association of Canada and to give to you a consumers' view of the energy situation.

Before looking at the uses of energy a word should be said about our sources of energy and the Canadian context. The Consumers' Association of Canada (or CAC as we are familiarly known), is concerned that the security of supply be firmly established. Given our northern climate and the fact that 90% of our energy supply comes from non-renewable sources, CAC sees the depletion of our resources of oil and gas, which is taking place at unsustainable rates, as a matter of vital concern to the consumers of Canada.

The potential for Canadians to be caught between a rock and a hard place when our resources of non-renewable energy begin to run out cannot be overstated. The combination of foreign ownership and continued export of our production (which currently stands at 40%) can only be offset by strong government policy. Security of supply must be assured, and much more effort must be made to further research into alternate sources of energy. CAC deplores the fact that currently the federal government has only committed 5% of its assistance to the energy sector to conservation and renewable energy. The other 95% is committed to megaprojects.

CAC believes that the supply generated by the megaprojects does not warrant the large expenditures of dollars (in capital contributions, loan guarantees and interest-free loans). We believe that Canadian consumers are better served by increased research and a firm commitment by the government, to a policy to ensure Canadian security of supply. I might add that security of supply does not just mean more pipelines and plants. It means also a policy of supply management. If we can alter people's energy spending habits, and I would submit to you that given the recent developments in the waste management scene we can do this, then these significantly altered habits can be as "secure" as new capacity.

If as consumers we look at a firm such as Ontario Hydro, do we see a commitment to conservation and demand management? There are innovative plans out there to push the consumer into an energy conservation and energy efficient frame of mind. I think of the "Refrigerator Buy-Back Program" of B.C. Hydro, introduced in January of 1988. Here in Ontario, and all across Canada consumers are realizing that there is no such thing as a "benign" source of energy. We must have energy. What we want is energy developed and used as effectively and efficiently as possible.

In preparation for this conference, I sent out a questionnaire on energy efficiency and conservation to our Ontario Consumer Network and also did a sample at a recent national conference. In this survey consumers have spoken clearly to say that energy-efficiency is a concern and is a consideration when they make a purchase. Consumers are not well enough informed about the subject, and they think conservation is the responsibility of all players in the energy game.

Let me share with you a few of the specific results of the survey. Overwhelmingly when asked if energy efficiency was a consideration when they made the purchase of a car, a house, or an appliance, the answer was yes, and the majority, 61% gave it a high priority. When asked whether the individual, government, industry or the energy producers should be responsible for energy conservation, the majority , 77% said that all of them have a role to play. 63% thought they were not adequately informed about energy efficiency. 48% were adequately informed about energy conservation. And overwhelmingly they said they would turn to government (rather than the utility or another source) for information.

The message is I think very clear. Consumers are concerned about energy efficiency and conservation and believe that all the players in the game should be as well. They do not feel adequately informed, and want government to give them information.

The last question the survey asked was about standards for energy efficiency and "harmonization" that will take place under the Free Trade Agreement. 77% replied that this harmonization should mean that the standard for the highest efficiency should be adopted, even if it meant increased production costs. I think both government and industry should be aware of the feelings of consumers on this issue.

As we approach the '90's, the big word seems to be the " E " word. Environment is the current rage, and energy will not be far behind as consumers continue to be educated by the media about the dangers facing society from our destruction of the environment. The connection will not be hard to make that the sources of energy, and our use of them, contribute directly to the state of our environment. The consumer demand for security of supply and for the wise and efficient use of energy can only continue to grow. Those producers of energy and manufacturers of products that use energy, who can demonstrate that they are wise users of energy, will be the leaders in the marketplace of the '90's. And that is, after all, the bottom line.

As a consumer, who is concerned about energy efficiency, the first place that I look at is my home. Recent figures from a Sept. 1988 Environics survey done for the Ontario New Home Warranty Program indicate that the new home buyer, once the choice of lot and style of home are made, then looks to energy efficiency as the next important criteria . The figures indicate that energy efficiency is being mentioned less frequently, but it is still there perhaps because they know they can do an energy retrofit later on. 41% of purchasers are saying they see an energy saving heating system as the most preferred option in a new house.

I might cite my own example. Last year we built a new home, and were advised to install an energy efficient gas furnace for our source of heat, and we also chose our water heating system using energy efficiency as an important criteria. We purchased new appliances and after doing some research (being a good consumer) and taking the Energuide numbers into account, we bought a refrigerator. I thought I had made a good energy-conscious choice. In the course of doing research for this speech I found a comparison of the current Canadian and new American standards. I went downstairs to look at my Energuide number and was, quite frankly, enraged to find that what I thought was an energy-efficient appliance did not meet the U.S. standard. Canadian consumers deserve better than this. What positive actions are the industry associations, CAMA and HRIA taking?

Canadian consumers are driving smaller cars, retrofitting their homes and yet we are told they are still not choosing or demanding more efficient appliances. One can legitimately ask why not.

One answer might simply be that the consumer has not been properly informed about the energy consumption levels of appliances. Where legislation has required energy consumption labelling, consumers have made informed purchase decisions which were recognized by manufacturers.

The Energuide Program is a case in point. Legislation was passed in 1978 as part of the Consumer Packaging and Labelling Act. Over the next few years the program expanded to included fridges, freezers, clothes washers, dishwashers, ranges, and clothes dryers. At that time Consumer and Corporate Affairs gave the Program a high priority and promoted it widely with an expensive advertising campaign. Consumer recognition of the Energuide label was good and the high visibility and effectiveness of the labelling prompted manufacturers to design and produce more efficient appliances to ensure their products had lower Energuide ratings than their competitors. Major efficiency gains were realized and by making informed choices, consumers were able to save hundreds of dollars in energy costs. When purchasing a refrigerator, they could save an amount in operating costs equal to, or greater than, the initial price over the life-time of the refrigerator.

As long as the Energuide Program was actively promoted by Consumer and Corporate Affairs, it was effective. By the mid eighties, Consumer and Corporate Affairs had lost interest in the Program although the legislation is still in force until March, 1990. Fortunately, Energy Mines and Resources were aware of the potential for energy conservation and the Program was transferred to their Ministry in 1987. The publication of the Energuide Directories has been resumed, studies have been commissioned and support for standard development has been forthcoming. The Program has not been promoted and all testing of the six appliances has ceased. The need for new legislation has been recognized but it has not been introduced.

CAC believes that at the Cabinet level, the political will just isn't there. This program is not very high on their list of priorities, if indeed it is even on their list! Consumers have not convinced their federal politicians that energy conservation is important to them - yet.

CAC has long believed that all levels of government should have energy policies, and that these policies should have a high priority and should promote conservation and efficient use of energy. As far back as 1978 energy conservation was flagged as a priority at our Annual General Meeting. As well as advocating energy conservation, we have strongly supported the development, production, promotion and sale of energy-efficient appliances. CAC has given the Energuide Program status at every Annual General Meeting, with greater emphasis since the Energuide Program started to crumble. The Program has been discussed at Board Meetings, articles supporting the Program have been published in *Canadian Consumer* and *Le consommateur canadien* and we have communicated with government leaders by letter and in person our support for the Program.

Let me give you briefly a summary of CAC's position on the Energuide Program:

- Canadian consumers can benefit greatly from an appliance energy conservation program that is mandated by federal legislation. The potential for savings is enormous.

- The current appliance energy conservation program should be continued and expanded to include heating and cooling equipment.

- Minimum energy consumption levels should be set at levels of reasonable efficiency (eg US levels) and incentives to manufacturers, retailers, and consumers considered.

- Mandatory performance criteria currently in effect should be maintained and the need for new ones reviewed. eg: dishwashers and microwave ovens.

- The Program should provide for testing to be done by independent, accredited testing agencies and for enforcement.

- The labelling program should be maintained as an incentive to manufacturers and consumers, but the methods of labelling should be reviewed.

- The government should undertake an extensive public promotion and education program directed at manufacturers, retailers and consumers.

For a variety of reasons the Energuide Program has lost its impetus. CAC would very much like to see it back on track and expanded. If there are improvements to be made, then lets make them and get on with the job of providing consumers with an informed choice of energy- efficient appliances.

Here in Ontario we are very pleased to have Bill 82, which passed in June of 1988. The explanatory note to the Bill says it all, "The purpose of the Bill is to encourage energy efficiency by setting energy efficiency standards for appliances and products. The regulations of the Bill are currently being finalized and CAC looks forward to their coming into effect in the fall of 1989.

CAC also looks forward to the development of performance standards of energy efficiency for the appliances and heating and cooling products specified. The sooner these are developed, are in place and are being adhered to, the better off Ontario consumers will be.

There is obviously a problem here of jurisdiction, there is also a concern on the part of Ontario about the intentions of the federal Department of Energy Mines and Resources. Quite frankly, the Consumers Association would like the Department to declare their position and indicate whether legislation is to be introduced to continue the Energuide Program. If they are not going to do anything, then they should step aside and let the provinces get on with it.

It is impossible to talk for very long about appliance energy-efficiency without making reference to the U.S. experience. The passage in 1987 of the National Appliance Energy Conservation Act has set out efficiency standards for the major appliances plus heating and air cooling appliances , to be met by 1990 and 1992. These are tough standards, and Canadian products except for some freezers and high efficiency gas furnaces do not meet them.
We note that Dow Chemical has just announced the production of two new gases for refrigerators which do not do damage to the ozone, so there should be no difficulty in meeting the new stringent standards.

With the advent of Free Trade, the Canadian appliance manufacturing industry is going to have to do a lot of catching up if they are going to remain competitive in the marketplace. I would remind you of the desire expressed by the consumers surveyed by CAC to have the harmonization of standards mean the adoption of the highest standard for energy efficiency.

The argument is probably made that all this energy efficiency is going to cost the consumer dollars. There does not seem to be much argument about that. However the flip side of those increased costs are the potential savings in dollars spent on energy consumption. To quote the 1987 Marbek Report "Appliance Efficiency Information Base" prepared for the Ontario Ministry of Energy:

> Consumers face slightly higher prices for energy efficient products but in all cases examined to date these costs were more than offset by reduced energy costs over the lifetime of the product. (p.26)

The message seems to be very clear. At the individual consumer level there are savings to be made, on a societal level there are savings to be made in terms of energy consumption and the larger environmental/societal costs incurred by increased energy demand. The only question seems to be, why are Canadian manufacturers not in the forefront of research and development to develop and produce a range of energy efficient appliances?

There could be several reasons for this.

First let me speak to the argument that there is no demand for this type of appliance in the Canadian marketplace. If the marketplace waited for consumers to "demand" a product, then we would all be living more simple lives. Advertising is proof that "Build a better mousetrap" is the way to get more customers, to increase one's share of the marketplace. It would seem that Canadian appliance manufacturers have not applied the principle of created demand to energy efficiency.

The marketplace is a volatile thing, and demands can be "created". One has only to look at the current recycling issue to recognize this. The consumer is susceptible to persuasion, particularly if there is moral suasion involved, as is the case with recycling, or if there are dollars involved as is the case with energy efficiency. Ontario consumers spend over $12 billion annually on energy consumption! Those consumers, given sufficient information, in a manner they can understand , could be persuaded without too much difficulty that they want energy-efficient appliances and products. In Ontario, the government is taking over the lead vacated by the industry. The manufacturer who accepts energy efficiency and uses it as a marketing tool and "creates " a demand that they can satisfy, will be the winner.

When talking about all this new energy-efficient product, I am of course taking essentially about Research and Development. In the context of the Canadian appliance manufacturing industry, research and development has, to put it charitably, not been a high priority. Part of this has to do with the nature of the industry. In Canada, it is essentially a branch-plant economy with respect to appliances. The three major companies and one of the smaller companies are owned and/or controlled by their parent US companies. What this has meant is that expenditure on R & D has been embarassingly small, and has tended to focus on process improvements to reduce costs and improve margins.

The exception to this has been the small Canadian-owned manufacturers (two of them) who have specialized in freezers, and because of their innovations, now produce some of the most energy-efficient and price competitive freezers in the world.

It can be done!

The evidence presented by the latest Marbek report " The Energuide Chronicles", Dec. 1988 shows clearly that the early gains made during the first five years of the Energuide Program have not been sustained. In virtually every case the conclusions range from "no change" to "modest improvements", and even in the case of clothes washers to "backsliding" (p.8)

CAC supports the conclusion drawn by the report that:

> ...effort should be devoted by the federal and provincial levels of government to the establishment of tough but reasonable minimum efficiency standards for major appliances and heating/cooling equipment. (p.10)

The combination of free trade, lagging developments in the production of energy-efficient product, the lead taken by the Ontario and U.S. governments in requiring high levels of energy-efficiency, coupled with potential consumer demand for these products does not paint a rosy picture for the Canadian industry. We can only hope that the Canadian appliance manufacturers will, figuratively speaking, pull up their socks, avail themselves of U.S. technology and equipment, give a higher priority to research and development, and begin to produce the energy-efficient product that will be demanded.

I am a Canadian who is loyal to Canada and who, like most Canadian consumers, wants to "Buy Canadian". But I also want to be a good consumer and shop wisely. I want to be able to choose energy-efficient appliances. Must these two goals be mutually exclusive

It is in the enlightened self-interest of every segment of our society to think and make decisions in terms of energy efficiency. We are seeing this kind of process begin to happen today in what is euphamistically called "waste management". The same process should be happening as we look at energy and our uses of it. There is a leadership role there for the taking by our governments (and our survey certainly showed an expectation that government has a strong role to play). And there is a leadership role there for corporations such as Ontario Hydro, and the industry Associations. To date I would submit that consumers have not seen much evidence of such leadership.

Making energy choices that will benefit us all as a country , and as a society , is surely the only way to go.

ENERGY CONSERVATION AND EFFICIENCY
IN TRANSPORTATION

Presented by

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ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

A. Background

Energy conservation started to receive considerable attention in the 1970s as a strategy to help us cope with disruptions in oil supplies and to prevent future chronic energy shortages. The perceived urgency of the situation at that time, underlined by rapidly escalating energy prices, produced a strong commitment for action that resulted in the implementation of numerous conservation initiatives, which, in retrospect, can generally be judged to have been quite successful. Concentrated efforts in all sectors of the economy contributed to an overall reduction in energy demand, which eventually resulted in the rationalization of oil production, levelling of energy prices, and finally in the stabilization and up-turn of the economy. It has been pointed out that the initial economic recession had a major effect on reducing energy consumption. Nevertheless, energy conservation efforts also played a significant part, and, in addition, helped to soften the impacts of the economic downturn.

B. Current Rationale

With the generally stable energy situation of today, it may be believed that energy conservation is no longer needed. That is, however, not the case. There are still three main reasons for energy conservation:

1. Economic Reasons

Economic reasons follow from the fact that energy is a component in the cost of all products and services in our economy. Energy conservation is a factor that can contribute to the efficiency of energy utilization, which can increase the overall efficiency of any production process. Increased efficiency can result in increased productivity and increased economic payoffs.

This situation is particularly true in the transportation sector, since transportation is energy intensive, and a component in practically all products and services. Increased transportation efficiency through increased energy efficiency and conservation, not only increases the competitiveness of the transportation industry, but also enhances the economic payoffs to the industries that use the transportation system.

2. Environmental Reasons

Environmental reasons arise from the fact that energy utilization, particularly the burning of fossil fuels such as oil products, produce pollutants that can effect our health, and gases that contribute to the greenhouse effect. By reducing energy consumption through conservation and efficiency measures, it is also possible to slow down the production of undesirable by-products.

3. Strategic Reasons

Strategic reasons arise from long-term implications of oil supplies and energy use. Oil is a non-renewable resource, and oil supplies will eventually decline. As demand begins to outstrip supply, prices will rise and eventually, alternative energy supplies will have to be found.

Efficient use of energy will extend the existing supply of oil, and will provide ample time for the development of viable alternatives in a rational, controlled manner. At the same time, it will help us reduce oil imports and thus, reduce our outflow of capital and improve our balance of payment situation.

From a more short-term perspective, efficient and rational energy use will prevent rapid increases in energy demand and will, therefore, avoid rapid increases in energy prices. Energy efficiency is, thus, a strategy for maintaining our current, stable and growing economy.

In addition, it is an important component in a strategy to maintain and improve our competitive position in a world economy where many nations are continuing to improve their productivities through further improvements in energy efficiency.

C. Transportation Energy Efficiency Strategies

In the analysis of conservation options for transportation, three strategies have been identified that result in increased transportation efficiency. These are:

1. Improving the efficiency of transportation technology.
2. Improving the efficiency of transportation operations.
3. Reducing travel demand.

Other strategies have been identified that can conserve fuel, but do not contribute to efficiency. These are:

1. Restriction of travel.
2. Allocation of fuel.

Such strategies can be appropriate when dealing with sudden shortages (contingency situations), but will not be considered here in the context of efficiency improvements. Instead, this overview will focus on the measures, opportunities, and benefits of the first three strategies.

1. Increasing the Efficiency of Transportation Technology

Since automobiles consume about 50% and trucks about 30% of all transportation energy, it is natural that much effort has been directed toward the improvement of automotive technology. Motivated and stimulated in part by the American Corporate Average Fuel Efficiency (CAFE) standards, the automobile industry has addressed fuel efficiency improvements through a range of technology improvements:

- vehicle weight reduction;
- engine improvements (fuel injection, computerized controls, engine design);
- improved transmissions; and
- improved aerodynamics of vehicles

Efficiency improvements have been noteworthy. Average fuel efficiency ratings of new automobiles has gone from 12 L/100 km (23.5 mpg) in 1978 to 8.5 L/100 km (33 mpg) in 1986, and truck fuel efficiency has gone from about 60 L/100 km (4.6 mpg) to 40 L/100 km (6.9 mpg) in the same period.

Examining the rate of fuel efficiency improvements over time (Fig. 1), it becomes evident that the greatest improvements were achieved in earlier years. Subsequent improvements have been smaller, as it has become increasingly difficult to develop and improve new technology. If current trends continue, it can be expected that average automotive fuel efficiency will reach about 7.6 L/100 km (37 mpg) in the year 2000.

This is not an unrealistic goal since there are still several areas of automotive technology, both for automobiles and trucks, where advances can be made, such as:

- lightweight, composite materials;
- variable speed transmission;
- engine design; and
- new types of engines (Sterling, turbine), including ceramic engines.

It should be stressed that the development of these technologies is a gradual process, and the benefits of the results will not be seen for some time. The developments will also be quite expensive, requiring an extensive R & D commitment by the auto manufacturers.

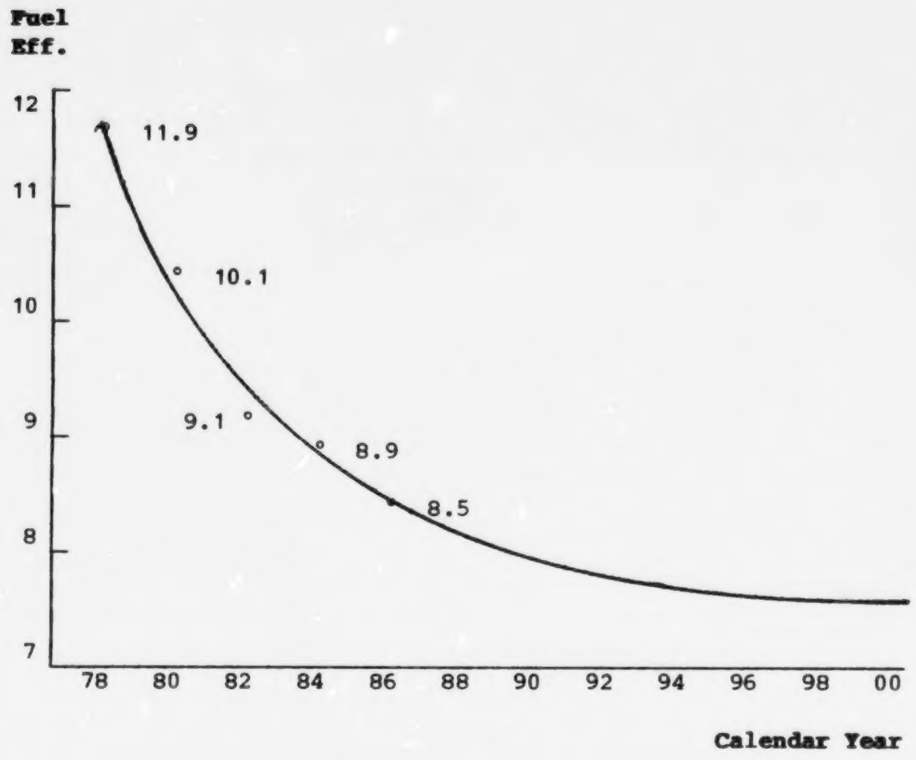


Figure 1
Change in Automotive Fuel Efficiency Over Time

Parallel to these developments, there will take place the development of alternative fuels technology for the use of propane, natural gas, methanol, and electricity. The use of these fuels or energy sources will reduce the use of petroleum and contribute to overall energy efficiency, since most ATF technologies are, in general, more efficient than the petroleum-based technologies they displace.

There will be technological advances in other transportation modes, particularly in the air and rail modes. Since these modes account for 7% and 6%, respectively, of total transportation energy consumption, their efficiency improvements will not have as great an impact on the overall transportation energy consumption as in the automotive area. Nevertheless, they will be very important to the industries in helping them maintain their competitive position in the overall transportation picture.

Aircraft technology improvements will be expected in:

- improved engine design (turbo props);
- laminated flow control; and
- composite materials for aircraft structures.

In rail technology, the main efficiency improvements are expected in:

- improved diesel design (wider fuel tolerance);
- rail lubrication; and
- redistribution of traction effect.

2. Increasing the Efficiency of Transportation Operations

There are three main approaches for improving the efficiency of transportation operations:

- improving the efficiency of utilization of the road and transportation system (transit, rail, air terminals, etc.);
- greater use of efficient modes in place of less efficient ones; and
- increasing the operating efficiency of the vehicles and vehicle fleets.

The most well known problem facing the current road and highway system in Ontario (indeed in North America) is traffic congestion. Congested streets and highways prevent an efficient flow of traffic, waste fuel in stop and go traffic, and add precious time to the transportation and delivery of goods. There have been estimates that up to 2 billion dollars are added annually to transportation costs in the Greater Toronto Area alone by congestion on our roads. Even if this is only an estimate, it is still clear that significant savings in energy and costs could be realized by improving the efficiency of our traffic flow.

There are, in fact, a number of measures that can be used to improve traffic flow within cities:

- coordination and optimization of traffic signals through computer controls;
- widening of intersections and introducing turn lanes;
- use of one-way streets;
- use of reversible lanes;
- imposing turn restrictions;
- eliminating on-street parking;
- eliminating 4-way stop signs; and
- etc.

All of these are well known by traffic engineers and planners. They have been used in most urban centres with varying degrees of success.

Computer controlled traffic signals have been installed, over the past 10 years, in practically all cities in Ontario. The improvements in traffic flows due to these devices has been measurable. Studies, based on traffic flow measurements before and after signal system implementation, have shown that the achieved traffic efficiency improvements have resulted in a saving of nearly a billion litres of fuel in Ontario since 1980.

As more and more cities install computer controlled traffic signals, further improvements due to this technology become limited. However, additional improvements are possible with a system enhancement that would monitor changes in traffic conditions over time, and would perform re-optimizations of signal timings and sequencing to best respond to the new traffic condition. Such a system is being developed and tested, and could be installed into existing computerized systems in Ontario in the next few years.

Implementation of various street improvements and traffic management measures - such as turn lanes, one way streets, and reversible lanes - has also been prevalent over the past 10 years, generally with positive results. However, in many cities there are limits to what can be achieved within the restrictions imposed by the physical makeup of streets and structures. Within municipalities there may also be conflicts, or perceived conflicts, between traffic efficiency and other community issues. For instance, it is clear that traffic flow can be improved on secondary thoroughfares by removing existing 4-way stop signs. However, the resulting increased flow of traffic would affect the quality of life within the neighbourhood and could be perceived as a safety risk.

Similarly, conflicts between traffic flow improvements and access to shopping are sometimes encountered with the introduction of one-way street systems.

In order to improve the efficiency of traffic flow on major highways within and around metropolitan areas (such as the 401 and QEW around Toronto), a number of freeway traffic management strategies can be used:

- controlled entry at interchanges;
- TV monitoring to ensure rapid elimination of obstructions (accidents); and
- early warning message signs.

Such strategies have been successful in some American and European centres, and they are being implemented on the freeways in the Metropolitan Toronto area. It is anticipated that they will produce a measurable improvement in transportation efficiency in this area.

It should be evident, however, that there are limits to what can be achieved by using traffic engineering and management techniques to increase transportation efficiency and to alleviate congestion. Critics have pointed out that in the face of rapidly increasing traffic volumes, such techniques are merely able to keep pace with increased demands on the system, without actually alleviating congestion. In actual fact, they do increase traffic efficiency by accommodating greater volumes on existing transportation systems, but it is true that they might not increase the efficiency of individual vehicles that still have to cope with the same traffic slowdown and delays.

In the current traffic situation, a major obstacle to improving transportation efficiency is the continual growth of commuter traffic, particularly the increase in the number of single-occupancy automobiles. Hence, an effective approach to alleviate congestion and increase transportation efficiency would be the shifting of commuter traffic from single-occupancy vehicles (which currently account for 70% of commuters) to public transit (currently 20%) - commuter rail, subway, LRT, buses - and other high-occupancy vehicles (currently 10%). That is: using strategies to improve transportation efficiency by encouraging the use of more efficient modes.

In the early 80's there was considerable debate about the relative energy efficiencies of various transportation modes. Controversy arose about the relative energy merits of heavy commuter rail versus subways and buses. There was debate about how to most accurately calculate the energy intensity of each mode; for instance, whether to include all the road construction energy for buses, or only part of it, and so on. Common to all analysis, however, was the fact that the actual energy efficiency of each mode depends highly on the load factors that can be achieved, and that every mode, with a reasonable load factor, is 10 to 15 times more energy efficient than a single-occupancy automobile.

Therefore, the practical question is no longer: "which of the transit modes is most energy efficient?", but "which mode is the most suitable for the intended application?", in terms of providing the required capacity, frequency of service, compatibility with the environment, etc., so that it can provide an attractive alternative to automobile commuting and attract the required ridership. Any one of the modes, when used to its intended capacity, is significantly more energy efficient than automobile commuting. Furthermore, in many cases there is not a question of choice of transit modes, but of strategies for enhancing the use of existing systems.

There are also many locations and situations where no transit mode is suitable, or where it is not a preferred option of commuters. In such situations, higher efficiency can be obtained by increased occupancy in car- and vanpools and other forms of high-occupancy vehicles. Various strategies exist to promote and facilitate the use of high-occupancy vehicles, particularly car- and vanpools.

In contrast with the traffic engineering and public transit measures for efficiency improvements, which fall entirely within government jurisdiction - local and provincial - car- and vanpool usage can be implemented by the private sector, with minimal government involvement. Car- and vanpools can be operated by private individuals, companies, and community groups, while governments can assist by providing incentives, information, and through promotion.

Although all of the transportation measures discussed above are energy efficiency measures and contribute to energy conservation, the current motivation for their implementation is to alleviate traffic congestion, - to control traffic volumes and to free up traffic flow. Energy efficiency and conservation needs further strengthen the arguments for undertaking such strategies and even underline the urgency for action, but the emphasis has shifted. It is no longer energy, but congestion.

Focusing for a moment on freight transportation, it has also been noted that its energy efficiency can be increased by the use of more efficient modes. As with transit modes, there has been considerable analysis of the energy efficiencies of the freight transportation modes. There is general agreement that the marine mode is the most energy efficient, followed by rail, road (truck), and air. At the same time, road transportation consumes the most energy, while transporting the least amount of freight (except the air mode). The situation in Ontario is illustrated in the table below.

Mode	**Percent Freight Transported**	**Percent Energy Consumed**
Marine	43%	13%
Rail	39%	11%
Road (truck)	18%	75%
Air	<1%	<1%

The total energy consumed in freight transportation amounts to 40% of total transportation energy consumption.

It may seem evident from the table that an easy method of increasing the energy efficiency of freight transportation, would be to shift freight from the road mode to the rail and marine modes. However, the economics of freight transportation do not depend solely on energy; many other factors must be considered, making the analysis extremely complicated. These factors include distances, speed of delivery, handling, packaging and storage requirements, size of shipments, flexibility of routing, value of the commodity, and many others. The result is, that in general the different modes are not interchangeable.

As a general rule, bulk commodities, such as iron ore, coal, and grain, are shipped via the marine mode; others such as forest products from inland sources, particularly in Northern Ontario, use the rail mode, while general freight, including cars and building materials, may use any of the three modes. There, the choice is heavily influenced by speed and handling requirements, as well as flexibility of access (door to door delivery). The result is that all urban freight transportation is done by trucks, and the shorter the distance, the greater is the use of truck transportation.

Nevertheless, there are possibilities of shifting general cargo movements from the road to the rail and marine modes, particularly with the introduction of packaging and handling techniques that allow more utilization of "piggy-back" and bulk loading technologies. In spite of these shifts, it is forecast that with greater use of "just-in-time" deliveries and dispersal of manufacturing plants, truck transportation will grow faster than rail and marine transportation in Ontario. In such a situation, greater energy conservation and operational efficiency results may be obtained by improving the energy efficiency of truck transportation, rather than just trying to shift additional cargo to the rail and marine modes.

The third component of the strategy to improve the efficiency of transportation operations deals with the operation of vehicles and fleets.

Studies have shown conclusively that a driver can have a significant effect on the actual operating fuel efficiency of a vehicle. The fuel efficiency of any particular vehicle may vary by 25% when operated by different drivers. In general, any driver can improve the fuel efficiency of his/her vehicle by 10-15% by adopting fuel-efficient driving and maintenance practices, such as:

- speed control;
- smooth accelerating, driving;
- proper engine maintenance;
- use of correct tire pressure; and
- etc.

It appears that current fuel prices do not offer sufficient incentive to the general licenced driver to motivate a consistent adherence to such fuel-efficient driving and operating practices for a reward of a mere 10-15% saving in fuel cost. However, the opportunity is there for any driver, and information about fuel-efficient practices is available from both provincial and federal governments.

The same vehicle operating and fuel efficiency improvements are, of course, available to commercial vehicle operators. In addition, there are numerous fleet operating practices that can increase the efficiency of fleet operation:

- computerized fleet management;
- route planning;
- vehicle monitoring (WAVM - via satellite communications); and
- equipment spec'ing.

Proper implementation and use of such efficiency improvement measures along with fuel-efficient driving practices can increase the operational and fuel efficiency of trucking and other commercial fleets by up to 15%. As an example, improved truck navigation and routing aids, as provided by monitoring and communication systems such as WAVM, can eliminate delays due to improper routing, which may add on up to 10% to existing transportation costs. Such efficiency improvements which translate into productivity gains, are significant incentives for trucking and other commercial fleets to implement appropriate operational and energy efficiency improvement programs. The provincial government assists fleet owners and operators by providing information on the implementation and benefits of a wide range of efficiency measures through its Trucksave and DriveSave programs. Follow-up with fleet operators who have implemented and used such measures, has shown that fleets can indeed achieve an average of 12% improvements in fuel efficiency. On the basis of such data, it has been estimated that fleet efficiency programs as provided by the Trucksave and DriveSave programs have helped the fleet industry save about 250 million litres of fuel over the past 10 years.

3. Reducing Travel Demand

The goal of the strategy to reduce travel demand is to perform the same business and organizational functions and to maintain the same level of economic activity as is done currently, but with less need to travel. This objective can be achieved two ways:

(1) Substituting travel with telecommunication.
(2) Restructuring our communities to reduce travel distances and eliminating travel needs.

Over the past 10 years, there has been considerable progress in introducing teleconferencing and other communications methods as substitutes for business travel. With the emergence of a teleconferencing industry that has developed and introduced these new technologies and methods, and is promoting their use, teleconferencing has become an accepted component in the way we do business. It is difficult to estimate how much travel has been eliminated by teleconferencing, since in many cases teleconferencing is used as an added method that increases the efficiency of conducting business, and not a total replacement of travel. Nevertheless, it is certain that a significant fraction of business travel is being replaced by this technology. With the growth of the teleconferencing industry and with improvements in teleconferencing technology, it is certain that this trend will continue.

The process of restructuring our communities to create transportation energy efficient environments has, and will, continue to be a difficult process with many challenges.

The land use and planning principles involved in this process have been extensively developed and are generally known to all planners; many jurisdictions have attempted to incorporate them in their official plans. They deal with various methods of creating communities within close proximity and easy access to employment, services, and recreation, and with ample provision for public transit and other energy efficient transportation modes such as walking and bicycling.

On more incremental levels, such principles also deal with the creation of efficient transportation corridors and with accompanying appropriate restrictions to limit traffic growth and control congestion.

Using and implementing such plans and principles has, however, proven to be very difficult due to conflicts with a variety of economic forces such as land values and market access.

On the whole, it must be concluded that in North America, success in this area has been sporadic at best. Some limited scale communities have been developed in accordance with transportation efficiency principles, but any larger scale or general application of such planning and land use principles is still in the future.

D. Summary

Considerable transportation energy efficiency improvements have already been attained through the implementation of the "easier" measures identified during the energy crises in the 70's, particularly in the areas of:

- automotive technology improvements;
- introduction and development of alternative fuels; and
- technological upgrading of traffic management.

Additional technological improvements in these areas will be slow, since in many cases significant breakthroughs or adoptions of new technologies are required. These will require heavy R & D commitments by the industries concerned.

Nevertheless, there is still scope for technological improvements, particularly in specific areas such as freeway traffic management, fleet management, navigation, and route selection. New technologies in these areas are, in fact, currently being implemented by various transportation industries.

There is also potential for substantial traffic efficiency improvements by shifting commuters from low-occupancy vehicles to more efficient modes - transit and other high-occupancy vehicles. However, innovative incentives, or possibly restrictions, and transit capacity increases are required to shift a significant number of commuters from their personal automobiles.

There is also scope for improvements in operational efficiency of all vehicles through improved driving practices and vehicle maintenance. So far, the benefits accrued from such personal driving improvements have been sufficient incentives only to commercial fleet operators. However, more widespread use of energy efficient driving and operating practices could reduce our transportation energy consumption by 10-15%.

Development of energy efficient communities in accordance with transportation efficient land use principles, could eventually lead to a major reduction in our transportation energy consumption. However, this approach can provide only long-term results, and would require considerable effort to overcome existing economic and political barriers to implementation.

In conclusion, it should be stressed that many energy efficiency improvements are still possible in the transportation sector. Such efficiency improvements are not only needed to save energy, but are vital to increase the efficiency of our industry in order to maintain a competitive position in a world where many nations are already operating at efficiency levels above ours, and are still introducing improvements. We can not afford to fall behind.

ENERGY MANAGEMENT AT INCO LTD.

Presented by

Claude R. Kerr
Superintendent, Central Utilities
Inco, Ltd.
Sudbury, Ontario

ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

I wish to thank the organizers of this conference for inviting me to be part of this panel on behalf of Inco Ltd.

My presentation will begin with a brief overview of our company. I will then describe efficiency improvements both in the past and future.

Inco Ltd. is the largest producer of nickel in the non-communist world, having 35% of the free world market and is also one of Canada's largest copper producers. In addition, we are a major gold producer, plus silver, platinum group metals, cobalt, sulfuric acid and alloys.

The company has two main business lines; primary metals and alloy products.

The primary metals group consists of: the Ontario division, which I'll be concentrating on in my presentation, Manitoba division, and P.T. Inco in Indonesia. The Ontario and Manitoba divisions have mining, milling, smelting and refining facilities, while Indonesia has an open pit and smelter facilities. In addition, Inco has nickel refinery facilities at Clydach, Wales and a precious metals refinery in Acton, England.

Inco alloy products company produces and markets a variety of high nickel alloys in rolling mill forms as well as forged and machined components in high performance alloys. The major operating units of Inco alloy products are located in the United States and the United Kingdom.

The largest primary metals division is located here in Ontario. In the Sudbury area there are 9 operating mines, 3 mills, a smelter, nickel refinery, copper refinery, sulfuric acid plant and sulphur dioxide liquidification plant. At Port Colborne, we have nickel and cobalt refineries.

In 1988, the Ontario division produced 249 million pounds of nickel and about the same for copper, as well as appreciable quantities of gold, silver, platinum, cobalt and sulphur products.

95% of our Canadian nickel production and half our copper production are exported. All the minerals we produce are international commodities with prices being set on world markets that are unresponsive to the Canadian domestic scene. As a result, we are unable to control our prices and must control our costs.

Since 1981, when we started a major push for productivity improvements, we have seen almost a 75% increase in pounds of nickel and copper produced per man shift with unit production cost remaining about the same as 1980, even after absorbing the effects of inflation.

As a result of these productivity improvements, we have been able to survive some very tough years while some of our competitors didn't. We are presently a profitable company. However, our business has historically been cyclical in nature and to survive in the future, we must continue to control costs.

Energy is one of our important cost factors representing about 10% of the total.

The Ontario divisions' 1988 utilization of energy included 1.7 billion kilowatt hours of electricity which accounted for nearly 70% of our total energy costs. This consumption represented about 1% of the provincial usage. 17% of the total electrical needs were supplied internally from our 5 hydro-electric plants and 2 steam turbines. Natural gas consumption was 8.9 BCF or about 1% of Ontario's total consumption. Oil usage totalled 130,000 barrels.

The company has 2 Oxygen plants that produced 400,000 tonnes for the smelting and refining processes. Production of oxygen accounted for 10% of our total electrical energy consumption.

Our total purchased energy cost in 1988 was $78,000,000 compared to $92,000,000 in 1981. Unit energy cost was 15.3 cents per lb. of copper plus nickel in 1988, versus 18.2 cents per lb. in 1981, in spite of a 50% increase in our purchase price of electricity.

Energy consumption per unit of output has dropped 30% from 43,000 BTU's per lb in 1981 to 30,300 in 1988. Beginning in 1989 major changes are planned in our milling, smelting and refining operations to meet government guidelines on sulphur emissions for 1994. As a result of these changes a further 15% reduction over 1988 is expected.

Electrical energy consumption per unit of production fell 7% from 1981 to 1988. Natural gas dropped 12% and oil 86%. From 1988 to 1995 it is expected that electrical energy will remain about the same while natural gas and oil will drop a further 17% and 33% respectively.

The reduction in electricity was restricted due to mining of lower grade ore and deeper depths causing increased power for mining and milling. In addition, although the use of oxygen in our processes greatly reduces overall energy consumption, its production requires large amounts of electricity.

The large drop in oil usage was due to conversion to natural gas as the result of lower prices and the governments off-oil program. Changes in natural gas fired processes and heating systems more than offset these conversion increases in natural gas consumption.

Over the next few years, we are embarking on a $500 million environmental program to reduce sulphur dioxide emission from the current level of 685,000 tonnes per year to 265,000 tonnes per year in 1994. Part of this program involves the bulk smelting of our ores in Inco developed flash furnaces. This process is very energy efficient and is the major reason for the projected drop in energy consumption over this period.

I will now mention some of the things Inco has done over the past to control energy costs. Time, however, does not allow me to go into details.

At Creighton Mine a natural heat exchange system occurs when ventilation air is drawn through a large mass of broken rock into the main intake airway. The broken rock, which is about 800 by 600 feet wide and 450 feet deep, warms the fresh air in winter and cools in the summer. Energy cost saving resulting from this ventilation system is about $1.0 million per year.

At our Stobie mine, ventilation air is heated in the winter and cooled in the summer by the freezing and melting of ice. The fresh air from surface is circulated through two large open stopes before reaching the main intake airway 300 feet below surface. During the winter, mine water is sprayed at the top of the stopes to form ice in the cold air. This ice is the main source of heat transferred to the air. Net annual operating savings is about $150,000 per year.

Precise temperature controls were installed in all the airways which now maintain the temperature within 1 deg.F. Air systems are being shut down and sealed during periods when ventilation is not required.

Compressing of air represents the largest single consumer of electrical power in the mines with a total capacity of 55,000 horsepower. Compressed air is required to operate drills and other equipment. To minimize usage, control valves which are operated remotely from surface, have been installed in areas where air is not required. High pressure booster compressors are used underground as near as practical to where the drilling takes place reducing leakage and increasing productivity. At the Frood-Stobie Complex, modifications to the air system presently going on will eliminate two 2,750 horsepower compressors.

The trend in underground equipment is towards electrical power which increases energy efficiency. We now have ten 8 cubic yard electric haulage machines in operation and to-date there appears to be both a significant performance improvement and energy cost savings, although the performance period has been too brief to project with accuracy. Data to-date indicates that the energy cost will be less than 50% of a similar size diesel machine.

After the ore is mined, it is transported to our mills where it is crushed and ground finely. The ore is then separated from the rock in a flotation process.

In our Stobie and Clarabelle Mills, reduction in heating costs were achieved by cutting back on roof vents, circulating the warm air at the ceiling and through more efficient use of heaters.

These changes resulted in a reduction in heating requirements from approximately 42,000 cubic feet of natural gas per heating degree a day in the late 70's to 25,000 in 1988. At today's costs this represents a saving of $500,000.

At Clarabelle Mill a research project jointly financed by Inco, Ontario Hydro and the Ontario government, is presently being carried out to increase fines in the crushing stage and reduce grinding requirements in the ball mills. The energy requirements in crushing is about one-fifth of that in grinding. The ore is reduced to 3/4" in a series of cone crushers which rotate at high speeds. A variable speed drive is being tested in order to determine the optimum speed. Preliminary data indicates that significant savings in electrical power are possible. However, problems with increased stresses and vibration plus choking of feed must be overcome.

The smelting process, which takes nickel and copper concentrates from the milling process, uses 40% of the total energy requirements for the Ontario division. Energy accounts for 30% of the smelters' total unit cost.

An audit of the smelter showed 45% of the purchased energy was used in the reverb furnaces. After carrying out a research and test program, Inco converted three reverb furnaces to a full oxygen/natural gas roof firing mode in place of the conventional end firing air/oil burners. The fuel requirements in these furnaces decreased by 45% while rate of smelting increased 50%. The conversion to natural gas was due to favorable cost differentials between oil and natural gas and government off-oil incentives. Residual oil remains as standby.

The responsibility for keeping our company informed on energy matters and making recommendations on energy rests within the Central Maintenance and Utilities Department, to which I belong. Our objective is 2-fold. - To assist management in minimizing the overall unit production costs through efficient energy management and to ensure an adequate supply of energy to meet present and future requirements.

Externally, we belong to and actively participate in, the Association of Major Power Consumers of Ontario (AMPCO) and the Industrial Gas Users Association (IGUA). These associations were formed to protect the interests of its members pertaining to energy matters.

We also participate on energy committees within the Ontario Mining Association and the Mining Association of Canada. In addition, we are actively involved in the Canadian Mining and Metallurgical Energy Conservation Task Force which meets regularly to share related ideas within the mining sector and keep the members informed on government programs. We also intervene in energy board hearings either directly or through the association.

We meet regularly with suppliers and government people to remain current on energy matters. Contract negotiations dealing with energy are handled through our department.

Although energy is a major cost factor, reliability of supply is equally as important. In this regard we have a serious concern that electricity shortages will occur in the mid 1990's if Ontario Hydro does not proceed quickly to build its next generating plant after Darlington. Energy conservation does not necessarily mean a decrease in electrical usage and therefore cannot be counted upon as a means of meeting our future requirements.

To sum up, our company has been actively involved in energy efficiency improvements for a number of years, beginning with the installation of waste heat boilers in the early 30's, the development of the mine air heating exchange systems at Creighton and Stobie in the 50's, the implementation of waste heat boilers for power generation in the 60's, to the future installation of flash furnaces in the smelter.

The success of our energy efficiency program is shown in the reduction of energy use by 30% and energy costs by 16% since 1981. Many of these costs savings were due to the deregulation of fossil fuels and the elimination of onerous governmental taxes. These have been positive steps by government to make energy supplies more responsive to market conditions. Government must also take the necessary steps to ensure that there is a secure supply for the future.

INCO LTD – ONTARIO DIVISION

1988 ENERGY USEAGE

ELECTRICITY	PURCHASED	1.4 BILLION KWHRS
	INTERNAL	0.3 BILLION KWHRS
	TOTAL	1.7 BILLION KWHRS
NATURAL GAS		8.9 BCF
OIL		130,000 BARRELS

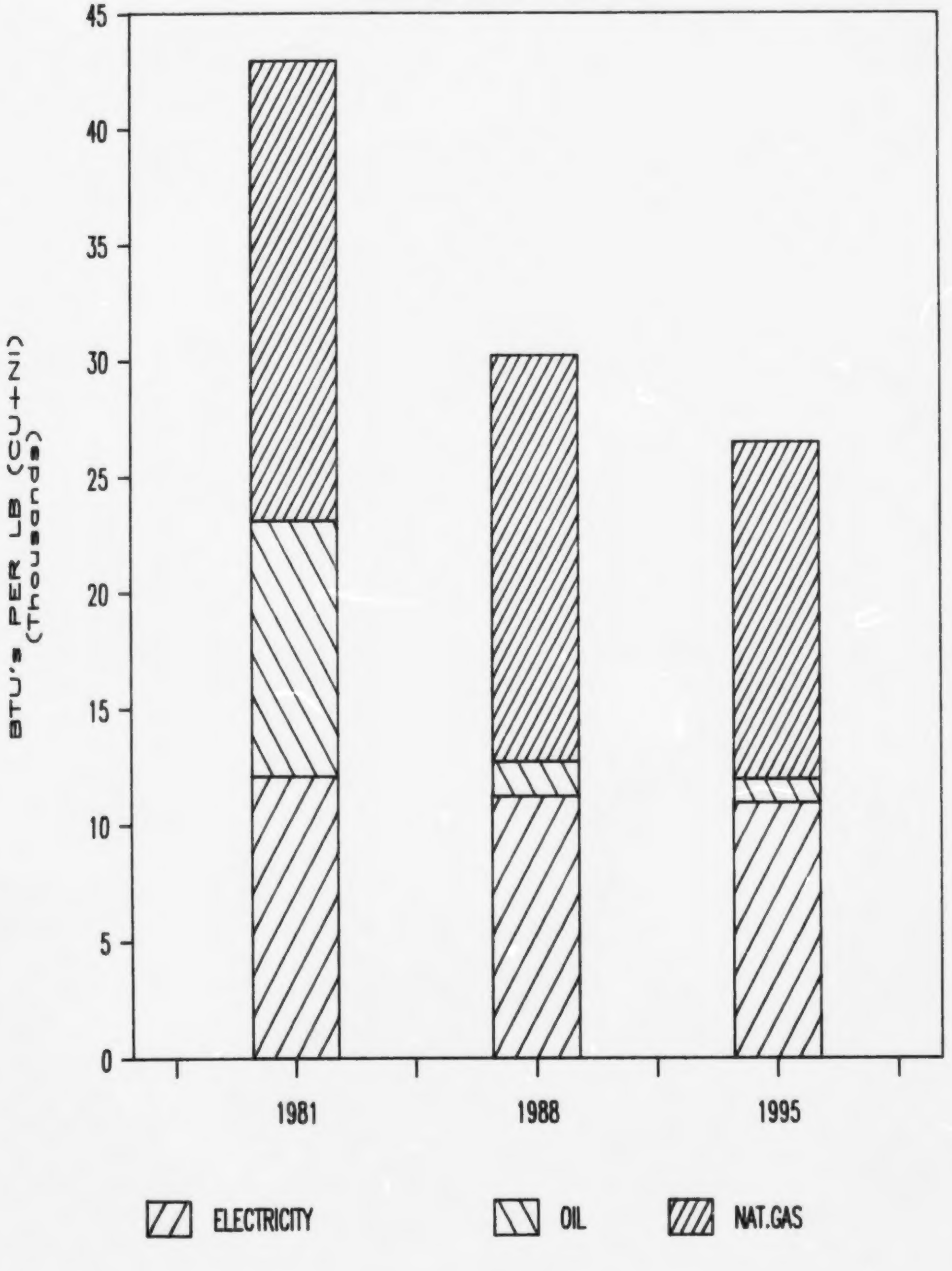
INCO LTD – ONTARIO DIVISION

ENERGY COSTS

	1981	1988
COST	$ 92,000,000	$ 78,000,000
PRODUCTION LBS (CU + NI)	504,000,000	510,000,000
CENTS PER LB	18.2	15.3

INCO LTD – ONTARIO DIVISION

ENERGY EFFICIENCY IMPROVEMENT



ENERGY EFFICIENCY AND CONSERVATION IN THE COMMERCIAL BUILDINGS SECTOR

Presented by

Ian A. Jarvis, P.Eng.
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Rose Technology Group Limited
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ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

Following the high profile of energy conservation activity in the 1970's, energy efficiency in the commercial sector is now only one of the many aspects of the management of heating, ventilation, air conditioning and lighting systems in buildings. Comfort and air quality have generally taken over as the number one concern of the building owner and operator. My paper today uses case study material to illustrate how energy retrofit of building systems, when properly engineered and implemented, can remedy indoor environment problems, reduce maintenance costs and extend equipment life.

(Slide 1) Figure 1 is drawn from ten of our recent retrofit projects in office, university, municipal and hospital buildings, and shows the breakdown of approximately $1.4 million of annual energy cost savings between the major energy retrofit measures.

Lighting accounts for 20 percent of the total energy savings. It is also one of the most interesting areas of retrofit, with a wide range of measures to choose from, and the necessity to carefully design changes to maintain or improve the aesthetic quality of the space.

Simple modifications, such as disconnecting fixtures, changing lamps and installing current limiters or phantom tubes have been used extensively in all kinds of buildings with varying levels of success. More comprehensive lighting redesigns are less common, but can substantially upgrade the appearance and effectiveness of a lighting system.

(Slide 2) The slide shows a typical floor of the National Life building in Toronto, where we installed paracube lenses, and selectively removed lamps to suit the requirements of different areas. The results are better looking space without the normal glare of a fluorescent lighting system, substantially lower electricity costs and reduced air conditioning loads.

Breakdown of Energy Savings for Ten Projects

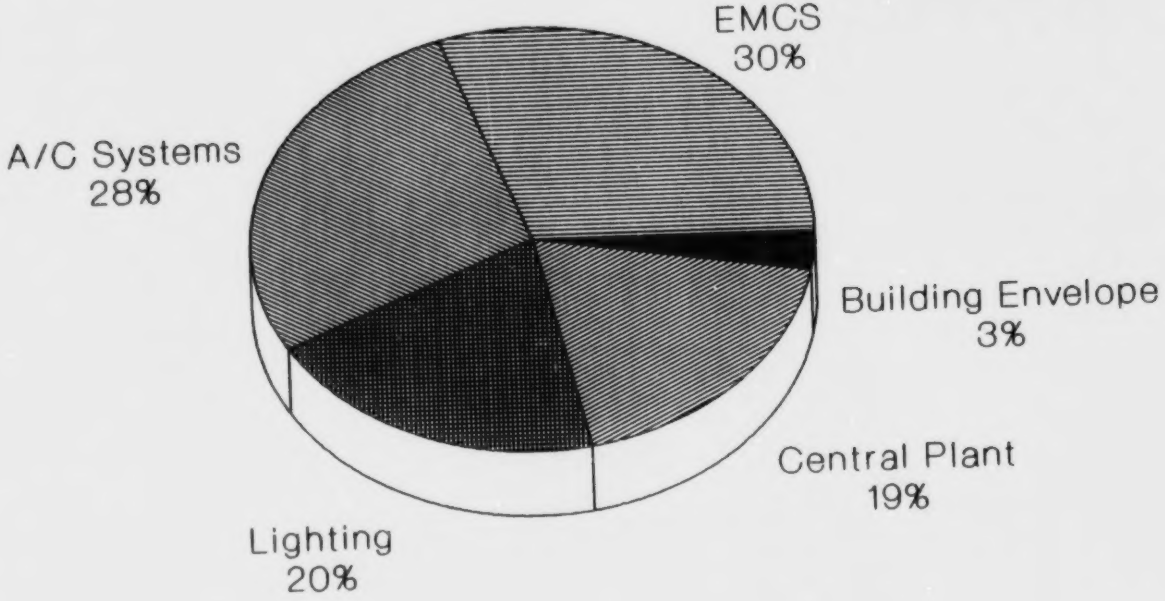


Fig.1 Rose Technology Group March 1989

Modifications to ventilation and air conditioning systems provide 28 percent of the total savings. Again, a variety of measures are employed to accomplish energy reductions, and care in design and implementation are essential to ensure that environmental quality is maintained or improved. Testing and redesign of air conditioning systems routinely uncovers problems with original design, construction and maintenance which limit their ability to provide consistent comfort conditions. Correction of these problems, in conjunction with the energy retrofit, leads to improved comfort as well as increased energy efficiency.

(Slide 3) The slide shows the Consumers' Gas regional headquarters in Mississauga where we retrofitted the air conditioning systems in early 1988. During the construction of the original building, a number of deviations from the design had been made, including cross-connection of ductwork between two air conditioning systems, and combining of zones with different cooling requirements. The systems were modified, resulting in improved comfort conditions together with a 50 percent reduction in the building's total energy use.

Energy management control systems - intelligent, microprocessor based controllers, networked together and programmed to suit the needs of the specific building - account for 30 percent of the total savings, through better control of the building systems, particularly during mild weather and periods of low occupancy.

These systems also contribute in a substantial way to the operation and maintenance of the building systems. For example, through the control system network, the operation of chillers and boilers can be programmed to respond to changes in outdoor temperature, to heating and cooling system operating temperatures, and to space temperatures throughout the building. By delivering only as much heating and cooling as is needed at a particular time, the efficiency of the central plant is improved, and energy consumption is reduced. In addition, the building manager can read and record the system and space temperatures and the operating status of the equipment. This allows earlier identification and better diagnosis of system problems as they arise.

(Slide 4) The slide shows one of the control panels of the system which we are installing at the Union Carbide office building on Eglinton Avenue in Toronto. The building occupants have suffered in the past from overheating on the south face in spring and fall. The energy management control system is expected to prevent this situation in future by anticipating the weather conditions and taking corrective action with the control of the heating and cooling systems.

(Slide 5) Modifications to central heating and cooling plants provide 19 percent of the savings, and are generally not noticeable to building users. The slide shows the boiler plant at Tillsonburg District Memorial Hospital, which incorporates two stages of heat recovery. The first is a conventional feedwater economizer, which can be applied economically to most boiler installations in commercial and institutional buildings. The water being supplied to the boiler passes first through a heat exchanger in the flue gases, which preheats the water and typically increases the boiler efficiency by 5 percent. The second stage of heat recovery is called a condensing heat exchanger, and can improve the boiler's efficiency by a further 20 percent. This type of installation is generally only economically viable in large institutional, industrial, apartment and hotel facilities, but brings the supplementary benefit of cleaning the flue gases before they enter the atmosphere.

(Slide 6) Boiler efficiencies can also be increased in simpler ways, including tuning existing controls, replacing controls, and insulation of uninsulated or poorly insulated piping and equipment. The slide shows the steam boiler in the African Pavilion at the Metropolitan Toronto Zoo, where a new insulation jacket is reducing summer gas use by 60 percent.

The final 4 percent of the savings are attributed to sealing openings in the building envelope which allow conditioned air to escape, and cold outdoor air to leak into the building in winter. Although its contribution to total energy savings is relatively small, this air sealing can have a noticeable effect on building comfort.

(Slide 7) The slide shows the Nurses' Residence of the Toronto General Hospital, where the retrofit program included closing openings in the penthouse. Considerable volumes of warm building air had been escaping through these openings due to the pressure of the cold outdoor air. Stopping this penthouse air escape, together with weather-stripping of exterior doors reduce the leakage of cold air into the lower levels of the building, saving heating energy and reducing the discomfort of drafts.

These examples serve to illustrate the broad benefits that energy retrofit can bring to commercial buildings. The general perception that energy efficiency is bought at the expense of occupant comfort is far from the truth. The investigation, testing and redesign work required for an energy retrofit program can also be expected to identify causes and solutions for comfort problems. Furthermore, the modified systems generally have lower maintenance requirements than the original installations, while old equipment is replaced, avoiding future capital expenditure.

Energy efficiency is clearly important from a social perspective. Reduced utility costs realized through energy management can also be significant, especially in institutional and owner occupied buildings. It is important to also appreciate that building system renewal resulting from an energy management program can bring additional comfort and cost avoidance benefits to owners, managers and occupants alike.

NOTES FOR REMARKS

BY

DANE MACCARTHY

VICE-PRESIDENT, ENERGY MANAGEMENT

ONTARIO HYDRO

TO

ONTARIO'S ENERGY CHOICES CONFERENCE

APRIL 3-4, 1989

ENERGY CHOICES

I AM PLEASED TO SPEAK AT THIS FORUM; AND TO HAVE JOAN AND CLAUDE AS FELLOW SPEAKERS. THEY REPRESENT SOME OF HYDRO'S MAIN CUSTOMERS, AND SO I SEE THIS AS AN OPPORTUNITY FOR US TO SHARE EXPERIENCES.

WE'RE LIVING IN AN INCREASINGLY COMPLEX WORLD. AND WHEN IT COMES TO ENERGY CHOICES IT'S CLEAR THAT THERE ARE NO EASY ANSWERS - - AND NO ONE ANSWER. IN FACT, THERE'S A BROAD RANGE OF OPTIONS AND SOLUTIONS - - THINGS LIKE THE POSSIBLE BREAKTHROUGH IN FUSION RESEARCH ADVANCED BY THE UNIVERSITY OF UTAH PROFESSORS OR THE MORE EXTENSIVE USE OF WOOD FOR FUEL SUGGESTED RECENTLY.

HOW DOES ENERGY CONSERVATION AND EFFICIENCY FIT IN WITH THESE AND OTHER SUPPLY AND DEMAND INITIATIVES? WELL, AT ONTARIO HYDRO, THE ANSWER IS "RIGHT AT THE TOP". CONSERVATION AND ENERGY EFFICIENCY WILL NOT BE THE ONLY INITIATIVES WE PURSUE TO MEET FUTURE ENERGY NEEDS BUT THEY ARE CLEARLY FRONT AND CENTRE ON OUR PRIORITY LIST.

AS MANY OF YOU KNOW, HYDRO RECENTLY SUBMITTED A DRAFT DEMAND/SUPPLY PLANNING STRATEGY TO THE PROVINCIAL GOVERNMENT'S SELECT COMMITTEE ON ENERGY. IN IT WE STATED THAT "DEMAND REDUCING OPTIONS WILL BE PURSUED TO THE FULL EXTENT THEY ARE ECONOMIC COMPARED TO THE AVAILABLE SUPPLY OPTIONS IN THE RELEVANT PLANNING PERIOD".

THE SELECT COMMITTEE SUPPORTED THIS PRINCIPLE AND IT IS ALSO CONSISTENT WITH THE POLICY OF THE MINISTRY OF ENERGY.

SO WHERE ARE WE? WELL, TODAY I'D LIKE TO TELL YOU A LITTLE ABOUT WHAT'S IN PLACE RIGHT NOW, WHAT WE'RE EXPECTING TO DELIVER OVER THE NEXT FEW YEARS, AND SOME OF THE ISSUES AND UNCERTAINTIES THAT AFFECT THE SUCCESS OF ENERGY EFFICIENCY AND CONSERVATION PROGRAMS.

LET ME START WITH HOW MUCH POWER THE PROVINCE WILL NEED IN THE COMING YEARS. WE HAVE PROJECTED THAT THE DEMAND FOR ELECTRICITY WILL GROW TO APPROXIMATELY 31,800 MW BY THE YEAR 2000. THAT IS, GIVEN THAT THE EFFICIENCY OF ELECTRICITY USE REMAINS AT THE 1985 LEVEL. THAT MEANS WE'RE LOOKING FOR ABOUT 8000 MW BY THE END OF THIS CENTURY. WE HAVE SET A TARGET TO PROVIDE 5500 MW OF THAT AMOUNT, THROUGH A COMBINATION OF DEMAND MANAGEMENT INITIATIVES AND PARALLEL GENERATION.

THE FIRST THING WE NEED TO DO TO MEET THAT TARGET IS CREATE AWARENESS BY PROVIDING CUSTOMERS WITH THE RELEVANT INFORMATION - WE WANT TO ENCOURAGE THEM TO REPLACE OLDER LESS EFFICIENT EQUIPMENT; TO SHOW THEM HOW EXISTING EQUIPMENT COULD BE USED MORE EFFICIENTLY; TO IMPROVE THE INSULATION OF THEIR HOMES; AND TO UPGRADE THEIR OFFICES AND FACTORIES, ETC. BY PROVIDING HELPFUL INFORMATION WE THINK ABOUT 1500 MW CAN BE SAVED.

ANOTHER 2000 MW SAVING IS EXPECTED AS A RESULT OF INCENTIVES TO STIMULATE IMPROVEMENTS IN ELECTRICAL EFFICIENCY THAT WOULD OTHERWISE NOT OCCUR. THIS, IN EFFECT, MEANS PROVIDING CUSTOMERS WITH A FINANCIAL INCENTIVE TO BUY ENERGY-EFFICIENT PRODUCTS OR ADOPT MORE ENERGY EFFICIENT METHODS.

NOW LET'S MOVE TO LOAD SHIFTING. WE BELIEVE WE CAN SAVE 1000 MW THROUGH CUSTOMERS RE-SCHEDULING SOME OF THEIR ELECTRICITY USE FROM THE HIGH DEMAND DAYTIME HOURS TO THE OFF-PEAK HOURS. THE INTRODUCTION OF TIME-OF-USE RATES THIS YEAR FOR LARGE INDUSTRIAL CUSTOMERS AND MUNICIPAL UTILITIES WILL HELP ENCOURAGE THIS SHIFT. THESE RATES WILL PERMIT OUR CUSTOMERS TO SAVE MONEY AND REDUCE THE PEAK DEMAND ON HYDRO'S SYSTEM.

FINALLY, WE ARE STRONGLY ENCOURAGING PARALLEL AND CO-GENERATION. THE TARGET IN THIS AREA IS 1000 MW. WE HOPE TO ACHIEVE THIS THROUGH GREATER ENCOURAGEMENT OF PRIVATE DEVELOPMENT OF ALL TYPES. AND WE ARE CURRENTLY IN THE PROCESS OF REVIEWING THIS TARGET. WE THINK IT CAN BE EVEN HIGHER. VERY RECENTLY, WE ESTABLISHED A NON-UTILITY GENERATION DIVISION TO UNDERLINE OUR COMMITMENT IN THIS AREA.

IN TOTAL, WE EXPECT TO SPEND MORE THAN $1.5 BILLION IN THESE AREAS OVER THE NEXT 10 YEARS. TO OUR KNOWLEDGE, THIS IS THE MOST AMBITIOUS DEMAND MANAGEMENT PROGRAM IN NORTH AMERICA TODAY.

BUT LET ME MOVE FROM THE GENERAL TO THE SPECIFIC. I WANT TO SAY ONCE MORE THAT OUR PROGRAMS ARE NOT JUST ON PAPER. OVER THE LAST FEW YEARS, WE HAVE MADE REMARKABLE PROGRESS IN OUR DEMAND MANAGEMENT EFFORTS. LET ME HIGHLIGHT JUST A FEW OF THE PROGRAM INITIATIVES:

- THE "ENERGY TIPS" PROGRAM, WHICH WE INITIATED TO HEIGHTEN PUBLIC AWARENESS OF ENERGY EFFICIENCY BY ENCOURAGING CUSTOMERS TO SEND IN ENERGY SAVING IDEAS, RESULTED IN 10,000 SUGGESTIONS; AND 32,000 PIECES OF ENERGY EFFICIENCY INFORMATION WENT OUT TO CUSTOMERS WHO REQUESTED THEM THROUGH THIS PROGRAM.

- A GROUND SOURCE HEAT PUMP WAS INSTALLED BY JANET LEE PUBLIC SCHOOL IN STONEY CREEK. ENERGY SAVINGS ARE ESTIMATED AT OVER $7,000 A YEAR, WITH A PAYBACK PERIOD OF LESS THAN 5 YEARS. OTHER SCHOOLS ARE STUDYING THE OPERATION OF THE SYSTEM FOR POSSIBLE APPLICATIONS.

- THE TORONTO HARBOUR CASTLE WESTIN SAVED OVER 33% ON THEIR TOTAL ELECTRICITY BILL BY RETROFITTING ENERGY EFFICIENT LIGHTING IN THE HALLWAYS AND PARKING GARAGE AND MAKING CHANGES TO THEIR HOT WATER HEATERS AND CHILLERS. PAYBACK PERIOD WAS LESS THAN 3 MONTHS.

- TWELVE COMPANIES INCLUDING FIRMS SUCH AS MOLSON'S, FALCONBRIDGE, H.M. SCHNEIDER, ETC., ARE PARTICIPATING IN ENERGY MONITORING DEMONSTRATION PROJECTS BEING DONE JOINTLY WITH THE MINISTRY OF ENERGY. THESE WILL IDENTIFY WAYS CUSTOMERS CAN USE ENERGY MORE EFFICIENTLY. AVERAGE ANNUAL SAVINGS COULD BE 16-20% WITH A 16-MONTH PAYBACK PERIOD. IN FACT, IN THE FIRST SIX MONTHS OF THE PROGRAM, MOLSON'S REALIZED A SAVING OF $20,000 ON REFRIGERATION COSTS ALONE.

- CUSTOMERS AND OTHER INTERNAL AND EXTERNAL STAKEHOLDERS' KNOWLEDGE OF ENERGY APPLICATION AND PRODUCT DEVELOPMENT INFORMATION HAS BEEN ENHANCED BY ADVERTISING, ENERGY MANAGEMENT PUBLICATIONS, ENERGY MANUALS, PRODUCT KNOWLEDGE SHEETS, BUILDING DATA SHEETS, REFERENCE AND DESIGN GUIDES, DEMONSTRATIONS, TRADE SHOWS AND RESEARCH PROJECTS.

- SUPPORT PROGRAMS HAVE BEEN DEVELOPED TO ENCOURAGE CUSTOMER PARTICIPATION. THESE INCLUDE THE ENERMARK LOAN PLAN, BUSINESS FINANCE PLAN, FEASIBILITY STUDY ASSISTANCE PLAN, AND ENERGY ADVISORY SERVICES.

GENERALLY, WE HAVE TRIED TO DEVELOP A SOLID UNDERSTANDING AND APPRECIATION OF CUSTOMER NEEDS AND MARKET OPPORTUNITIES. AND WE HAVE ENCOURAGED MUNICIPAL UTILITY AND ALLY SUPPORT AND INITIATED CONCEPT TESTING AND DEMAND MANAGEMENT RESEARCH.

WE HAVE ESTABLISHED A PROGRAM DIRECTION FOR EACH OF THE THREE MARKET SECTORS - RESIDENTIAL, COMMERCIAL AND INDUSTRIAL. AND PROGRAMS HAVE BEEN DEVELOPED TO MEET SPECIFIC NEEDS OF CUSTOMERS IN EACH SEGMENT. TIME WILL NOT ALLOW ME TO DETAIL OUT THESE PROGRAMS. BUT GENERAL PROGRAM STRATEGIES INCLUDE THE FOLLOWING:

- IN THE RESIDENTIAL (AND COMMERCIAL) AREA, THE FOCUS WILL BE ON NEW CONSTRUCTION TO MINIMIZE LOST OPPORTUNITIES FOR EFFICIENT EQUIPMENT AND PROCESS DESIGN.

- CUSTOMIZED ENERGY AUDITS, AND MARKET AND DEMAND MANAGEMENT RESEARCH WILL BE USED TO DEFINE EFFICIENCY IMPROVEMENT OPPORTUNITIES, MARKET BARRIERS. THEY WILL ALSO DETERMINE WHERE INCENTIVES ARE NECESSARY TO IMPLEMENT SUCH OPPORTUNITIES.

- A HIGH PRIORITY WILL BE PLACED ON INCREASED DEVELOPMENT AND TESTING OF ELECTRICALLY EFFICIENT PRODUCTS AND ENERGY EFFICIENT ELECTRIC TECHNOLOGIES TO ENSURE THEIR AVAILABILITY FOR USE IN PROGRAMS.

- PROGRAMS WILL BE FLEXIBLE TO RESPOND TO CHANGES IN ELECTRICAL LOAD GROWTH, AND TO CHANGES IN THE MARKETPLACE.

- IMPLEMENTATION OF INCENTIVE-DRIVEN ELECTRICAL EFFICIENCY PROGRAMS WILL ENSURE THAT BY THE EARLY 1990'S A BROAD PORTFOLIO OF PROGRAMS WILL BE AVAILABLE FOR DELIVERY TO CUSTOMERS. THIS WILL ENABLE THEM TO CHOOSE PROGRAMS THAT BEST SUIT THEIR INDIVIDUAL NEEDS.

- THERE WILL BE SIGNIFICANT OPPORTUNITIES FOR THE PRIVATE SECTOR, I.E., ENERGY CONSULTANTS, ARCHITECTS AND CONTRACTORS, TO ASSIST HYDRO AND THE MUNICIPAL UTILITIES IN PROGRAM DELIVERY.

I WILL ALSO MENTION THAT SOME OF THE INITIATIVES HIGH ON OUR LISTS ARE: THERMAL ENVELOPE UPGRADES; NEW HOUSING THERMAL ENVELOPE; GROUND SOURCE/BIVALENT HEAT PUMPS; ENERGY MANAGEMENT SYSTEMS; HIGH EFFICIENCY LIGHTING; DIRECT CONTROL OF WATER HEATING; TIME-OF-USE RESEARCH; ENERGY AUDITS; HIGH EFFICIENCY MOTORS; VARIABLE SPEED DRIVES; AND SEVERAL MORE.

BUT WE ARE INTERESTED IN RESULTS, NOT JUST ACTIVITIES. WHY IS IT THAT MOST ENERGY CONSERVATION AND EFFICIENCY EFFORTS THROUGHOUT NORTH AMERICA HAVE BEEN LESS SUCCESSFUL THAN THEY WERE EXPECTED TO BE? THERE ARE MANY EXCUSES - BUT I THINK THERE ARE TWO FUNDAMENTAL REASONS - WE HAVEN'T PAID ENOUGH ATTENTION TO WHERE CUSTOMERS REALLY WERE RATHER THAN WHERE WE THOUGHT THEY SHOULD BE. THE OTHER REASON IS THAT WE HAVE TENDED TO IGNORE THE DISTRIBUTION CHANNELS.

LET ME GIVE YOU A FEW EXAMPLES - I HAVE HERE A 15 WATT ENERGY EFFICIENT LIGHTBULB. IT COSTS $18.00 DOLLARS AT ELECTRICAL SUPPLY STORES. USED IN THE AVERAGE HOME REPLACING THE BULB WHICH IS MOST FREQUENTLY USED, IT HAS A PAYBACK PERIOD OF 1.7 YEARS. IT'S LOGICAL; IT'S RATIONAL; IT'S ECONOMIC. HOW MANY OF YOU HAVE ONE IN YOUR HOME? AND I SUSPECT THIS AUDIENCE PRIDES ITSELF ON BEING MORE LOGICAL AND RATIONAL THAN MOST!

SO WHY SUCH A LUKEWARM RESPONSE? IT COULD BE THE UP-FRONT CAPITAL INVESTMENTS, THE SKEPTICISM ON CLAIMS, THE TRADITIONAL BUYING PATTERNS AND THE LIMITED AVAILABILITY ARE A FEW REASONS. ALSO, IT LOOKS AWKWARD. IT MIGHT NOT FIT IN MY LAMP (IN SOME CASES IT DOESN'T). WILL IT GIVE ME A DECENT LIGHT?

THESE ISSUES ARE THE ONES WE HAVE TO ADDRESS EFFECTIVELY AND IN TERMS THE AVERAGE PERSON CAN UNDERSTAND - NOT THE DETAILED TECHNICAL ANALYSIS OF EXPERTS.

A SURVEY WE CONDUCTED RECENTLY REVEALED INTERESTING COMMENTS FROM CUSTOMERS. WHILE IT WAS SPECIFICALLY ON TIME-OF-USE RATES, I THINK THEY ARE A PRETTY GOOD CROSS-SECTION OF CUSTOMER VIEWS.

- "I LIKE MY INDEPENDENCE - DO MY WORK WITHOUT WORRYING ABOUT PEAK TIMES".

- "ENJOYED TRYING TO FOLLOW PROGRAM. THINK IT IS A GOOD PROGRAM AND EVERYONE SHOULD BE ON IT. MAKES YOU AWARE. WE HAVE APPRECIATED BEING PART OF LAST STUDY".

- "HUSBAND DOES NOT LIKE THE UGLY LOOKING BOX OUTSIDE".

- "NOT WILLING TO ACCEPT AT FACE VALUE THAT HYDRO IS TRYING TO SAVE US MONEY; JUST TRYING TO JUSTIFY A RATE INCREASE".

- "I'M TOO OLD TO WORRY ABOUT SCHEDULES".

- "WITH ALL THE EFFORT WE ALL MADE WE EXPECTED A LOT MORE THAN $10 A YEAR".

IN ADDITION TO GENERAL ATTITUDES OF CUSTOMERS SUCH AS THOSE WE'VE JUST DESCRIBED, WE NEED TO KNOW MORE ABOUT THE STAGES A CUSTOMER GOES THROUGH WHEN MAKING A BUYING DECISION. THESE ARE TYPICALLY AN AWARENESS AND KNOWLEDGE STAGE, A LIKING OR PREFERENCE STAGE, AND A CONVICTION AND ADOPTION STAGE. IF WE WANT TO EFFECTIVELY ENCOURAGE CONSERVATION AND ENERGY EFFICIENCY, WE MUST GEAR OUR COMMUNICATIONS TO WHERE THE CUSTOMER IS AT. AN INCENTIVE OR REBATE APPEAL TO BUY WILL NOT BE EFFECTIVE IF THE CUSTOMER HAS DEVELOPED LITTLE AWARENESS OR PREFERENCE.

WE ALSO NEED TO KNOW WHO MAKES THE BUYING DECISION AND WHY IT IS MADE. FOR EXAMPLE, 79% OF THE PEOPLE IN OUR PILOT GROUP SAW AS A PERCEIVED BENEFIT, THE OPPORTUNITY TO SAVE MONEY; 6.3% SAW ENERGY CONSERVATION AS A PERCEIVED BENEFIT. YOU AND I MIGHT LIKE TO APPEAL TO POTENTIAL TOU USERS ON THE BASIS THAT IT IS THE RIGHT THING TO DO BECAUSE IT CONSERVES ENERGY. BUT IF WE LIMIT OUR APPEAL THIS WAY WE WON'T BE SUCCESSFUL. THAT'S NOT WHAT'S MOTIVATING THEM. USING ANOTHER EXAMPLE, IN OUR ENERGY EFFICIENCY MOTOR PILOT PROGRAM WE EMPHASIZED THE INCENTIVE AND DIDN'T PAY ENOUGH ATTENTION TO THE CUSTOMER'S FIRST CONCERN - RELIABILITY. WE'RE MODIFYING THE PROGRAM NOW TO EMPHASIZE BOTH RELIABILITY AND ECONOMY.

AND IF WE CAN LINK OUR APPEALS TO ISSUES THAT ARE OF CONCERN TO CUSTOMERS, WE STAND TO HAVE A BETTER CHANCE OF SUCCESS. FOR EXAMPLE, THE ENVIRONMENT IS CLEARLY A MAJOR ISSUE ON THE PUBLIC AGENDA RIGHT NOW. ANY ENERGY EFFICIENCY PROGRAM THAT ALSO HAS AN ENVIRONMENTAL ADVANTAGE WOULD LIKELY BE MORE READILY ADOPTED BY AN ENVIRONMENT-CONSCIOUS PUBLIC.

LET ME RETURN TO MY LIGHTING EXAMPLE FOR A MOMENT. PRINCE EDWARD ISLAND HAS THE MOST EXPENSIVE ELECTRICITY IN CANADA. THEREFORE, ACCORDING TO ECONOMIC LOGIC, A PRODUCT SUCH AS AN ENERGY EFFICIENT LIGHT SHOULD HAVE THE HIGHEST PENETRATION

RATE IN P.E.I. SINCE IT WOULD HAVE THE QUICKEST PAYBACK. YET IT HAS THE LOWEST. WHY? WELL IN ADDITION TO THE POINTS I MENTIONED EARLIER ON CUSTOMER READINESS TO CONSIDER A PURCHASE, THE DISTRIBUTION CHANNELS ARE SIMPLY NOT IN PLACE - THESE ARE THE CONTRACTORS, THE MERCHANDISING OUTLETS, THE VARIOUS SUPPORT PERSONNEL NECESSARY TO GET THINGS TO THE MARKETPLACE AND TO SERVE THE PRODUCTS ONCE THEY ARE IN THE CUSTOMER'S HANDS.

IF WE ARE TO DELIVER ENERGY EFFICIENCY PROGRAMS HERE IN ONTARIO, THERE HAS TO BE SUPPORT ALL THE WAY. IN OUR CASE, THE GOVERNMENT, THE UTILITIES, THE MANUFACTURERS, THE DISTRIBUTORS, THE CONTRACTORS, THE ENERGY SERVICE COMPANIES - - ALL HAVE TO BE TUNED IN AND SEE A POSITIVE BENEFIT FOR THEM.

WE, AT HYDRO, ARE TRYING TO ADDRESS SOME OF THESE ISSUES. WE HAVE A MAJOR ADVERTISING CAMPAIGN WE'VE JUST STARTED - "PEOPLE ARE TALKING, HYDRO IS LISTENING". AND DEMAND MANAGEMENT WILL BE A MAJOR FOCUS OF THAT CAMPAIGN. WE HAD A VERY SUCCESSFUL FRIDGE THERMOMETER CAMPAIGN TO PROMOTE AWARENESS AND ACHIEVE ENERGY SAVINGS. A COUPLE OF WEEKS AGO, I WAS IN BROCKVILLE WHERE WE LAUNCHED A STREETLIGHTING CONVERSION CAMPAIGN WITH SIGNIFICANT INCENTIVES (EVEN THOUGH, FROM AN ECONOMIC POINT OF VIEW, INCENTIVES SHOULD NOT BE NECESSARY). WE ARE TRYING HARD TO KEEP OUR ALLIES IN THE DISTRIBUTION CHANNEL INFORMED OF OUR PLANS.

I BELIEVE WE CAN ACHIEVE SOME REAL SOLID RESULTS.

THE POINT IS, WE DON'T JUST WANT ENERGY CONSERVATION AND EFFICIENCY TO BE THE ONLY ENERGY CHOICE - - AND WE DON'T JUST WANT IT TO BE THE FIRST CHOICE - - WE WANT IT TO BE THE BEST ENERGY CHOICE FOR THE CUSTOMER. AND IF WE CAN TAILOR OUR EFFORTS MORE EFFECTIVELY AND WORK TOGETHER, WE CAN MAKE THAT HAPPEN.

- 30 -

CANADIAN INDUSTRY PROGRAM FOR ENERGY CONSERVATION

Presented by

W. Peter Torbet
Chairman, CIPEC Council
3M Canada Inc.
London, Ontario

ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

The Canadian Industry Program for Energy Conservation (CIPEC) was established as a co-operative venture of industry and government. The objective of the program was to address and find a solution to the problems facing industry as a result of the energy crisis of the 1970's. The aims and objectives are:

- set voluntary energy efficiency improvement goals
- report on progress towards goals
- increase energy management awareness
- exchange information on energy management and technology
- participate in industry-government dialogue on energy conservation matters

As a consequence of that background our objective in participating in this Conference is to communicate the opportunity that energy conservation (read energy productivity) represents as we consider future energy requirements.

The reason we want to do that is we believe effective energy use can make a significant contribution to Canada's future - competitiveness, environment, growth, sustainability. The rationale for such an objective is not altruistic but has a strong basis in economics. I would like to review with you today:

1) the potential levels of energy intensity improvement of Canadian industry.

2) indicate how these can be achieved

3) relate the impact to Canada's energy demand

4) suggest what actions can contribute to these benefits

(Slide 1) This graph shows the progress to date and the potential under several different scenarios for improvement of energy intensity.

- the top line indicates industrial energy consumption with no energy intensity improvement
- the lower line to 1987 indicates the energy usage reduced by the actual improvement in energy intensity - 25.8% to 1986
- the future can be considered with several scenarios:
  - no further improvement in energy intensity over current rate
  - no improvement after attainment of 1990 CIPEC goal
  - usage based on CIPEC goals extended at the 1.44% per year rate of improvement to 2005
  - usage based on further improvements as a result of assistance to approach the economic potential of the opportunities
    - the economic potential is that level of improvement that can be achieved with increased emphasis and programs to support energy productivity improvement

The probability of achieving this extended goal and the economic potential goal can be assessed by considering the opportunities in two areas:

- direct energy technologies and methods
- changes to industrial processes

The direct energy technologies and methods that will result in energy intensity improvements include:

- electrical efficiency improvement
  - lighting
  - variable speed drives
  - efficient motors
- heat recovery
  - heat exchanges
  - heat pumps
  - efficient motors
- metering and monitoring
  - energy audits
  - automatic controls
  - programmable controllers

- efficiency improvement of conventional energy systems
    - HVAC
    - boiler performance
    - steam distribution systems

The key point we would like to make is that these are established technologies. It will take years for industry to put in place all of the energy technology and methods improvements that are commercially available today. What is required is education, communication, etc. to increase awareness of the opportunities - provide a catalogue for industry to use these opportunities to their advantage - overcoming awareness and information barriers.

The second area of opportunity is the change in industrial processes that results in an energy intensity improvement. The opportunities will be realized in different ways:

- implement known technology as growth supports additional capacity or replacement is required
    - the pulp and paper industry is a good example and an IEA study concludes that a modern pulp and paper operation in the future can deliver not only its traditional main products but energy or energy carriers for external use - this from an industry that consumed 22.7% of the energy required by all manufacturing industries in 1982
    - 3M Company also has a relevant example, in 1981 we needed additional tape coating capacity and installed a new process three times more efficient.
- implement known new technology based on financial opportunity, i.e. payback or rate of section
    - an example is the change to the dry process in the cement industry a 30% reduction in fuel consumption
- develop new technology to make improvements towards the theoretical energy requirements
    - despite significant improvements the cement industry still uses three times the theoretical requirements for material conversion
    - opportunity for R&D demonstration, prototype plant

These process opportunities are quite different from those in the energy technology as:

- considerable investment is required
- the risks can be significant
- the technology is often unknown or uncertain

But the potential is there. After the year 2000 the majority of the improvement will be generated from these process changes.

The final questions then are:

  - Which level of imrovement should be our objective?
  - How do we get there?

I would suggest the objective should be to approach the economic potential - that being the best strategy for Canada and Canadian industry.

(Slide 1) Looking again at the graph of CIPEC results:

  - the present program is needed to achieve the 1990 goal
  - CIPEC organization
  - class 34
  - Ener demo

- not going to extend CIPEC goal to 2005 without some extension and additions to present emphasis

- certainly not going to approach economic potential without more assistance

  - education
  - acceleration of implementation
  - process improvement
  - emphasis - gov't leadership
  - shift in mindset

- what policy direction

  - CIPEC has a role to play to provide direction for industry needs and would propose the following:

    1) ensure there is equal emphasis on demand side energy economics

    2) commit to assist industry in the broad sense to implement energy technologies and methods - technology transfer

    3) consider R&D opportunities in industry sectors to generate Canadian opportunities

(Slide 2) The net result of these alternate scenarios is shown on this graph where base data is taken from the NEB 1986 report.

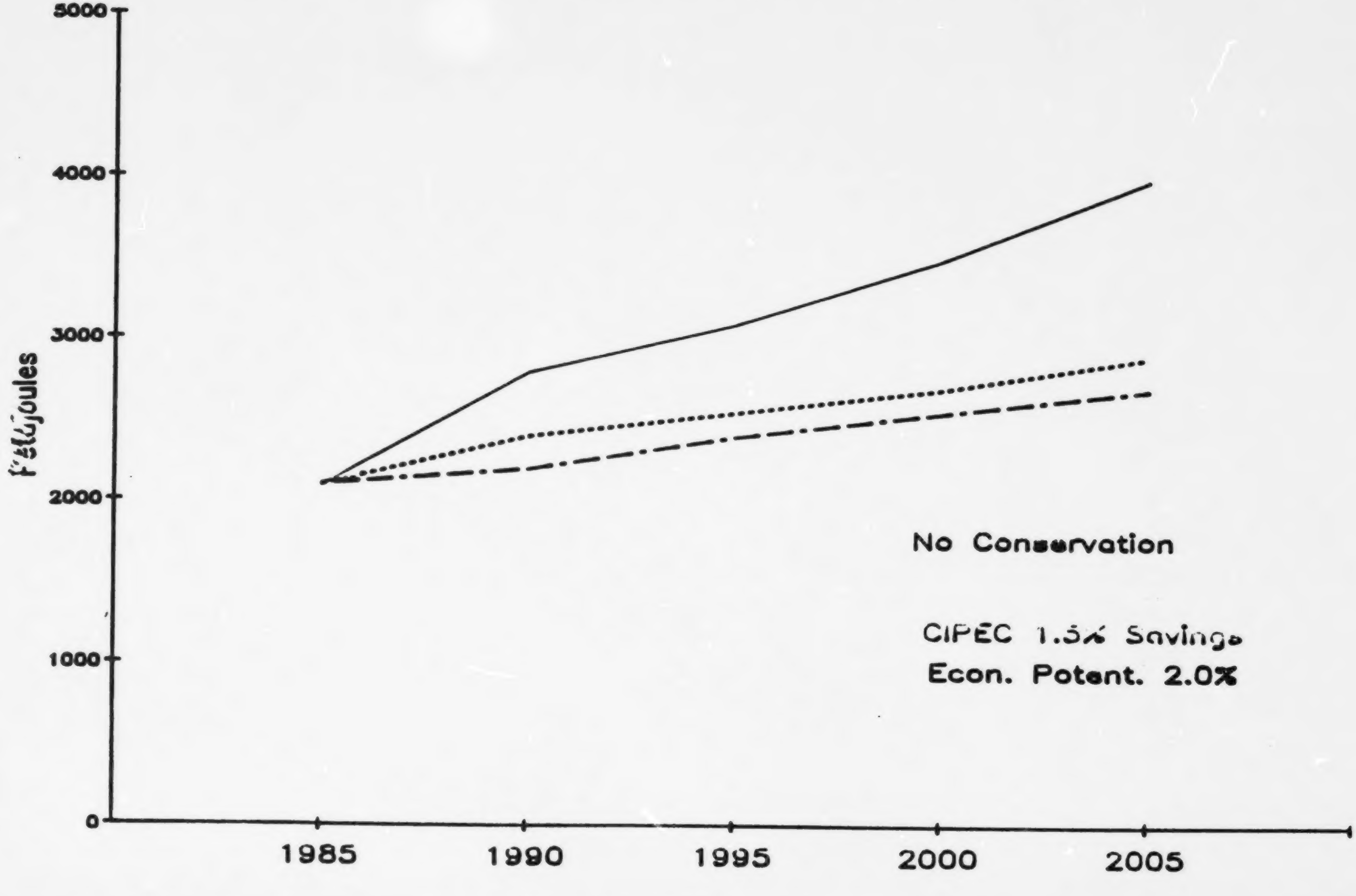
- the NEB est. of consumption is shown and considers .8%/yr. conservation or energy productivity improvement

- for reference have shown result with no improvement

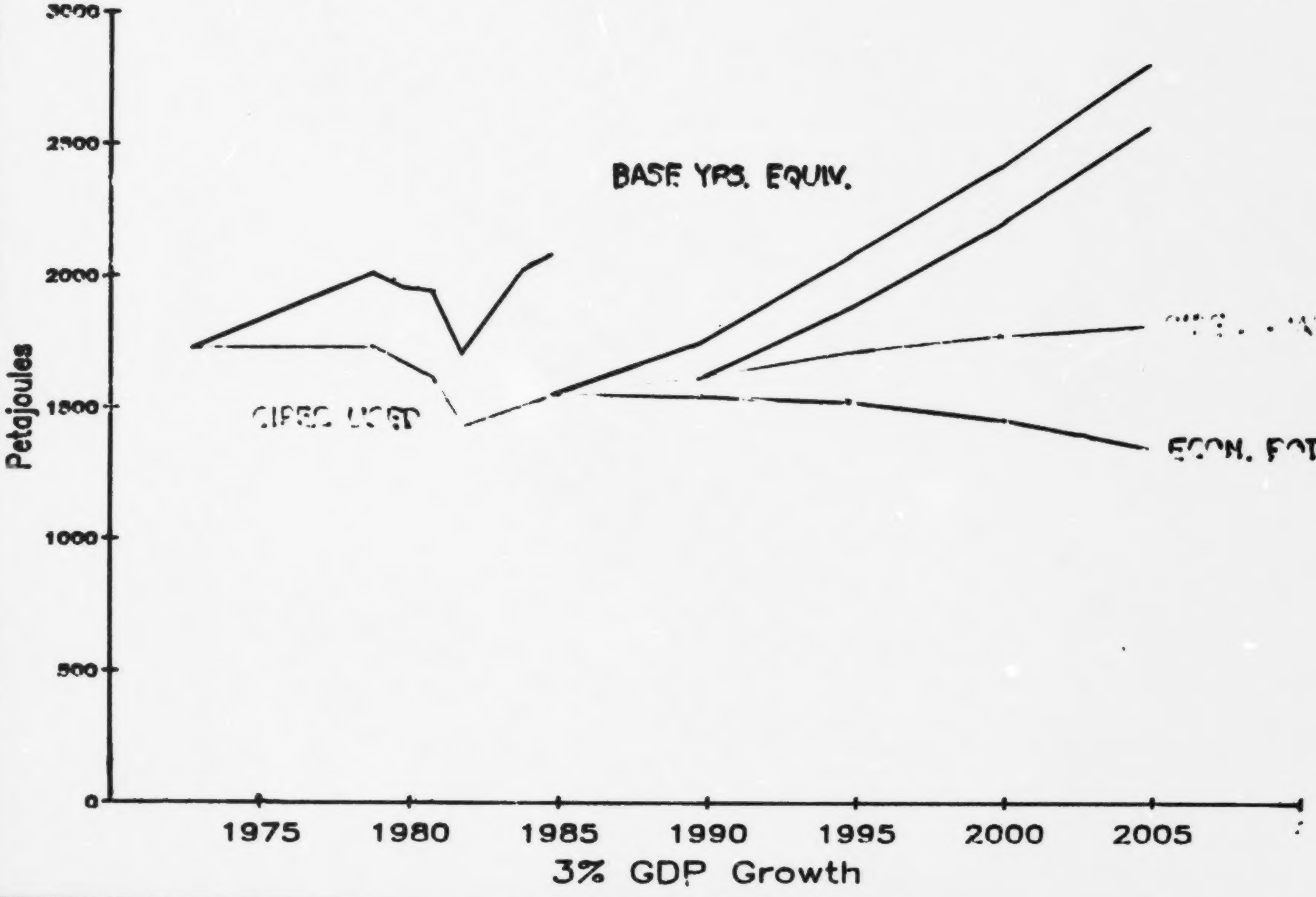
- show CIPEC saving to 1990 extended to 2005

- show economic potential 2%/yr.

INDUSTRIAL ENERGY DEMAND 1984—2005
Based on NEB High Price Case



CIPEC ENERGY CONSERVATION
Progress to Date—Goals—Economic Potential



3% GDP Growth

ALTERNATIVE TRANSPORTATION FUELS

ONTARIO'S ENERGY CHOICES

Remarks By.

R. M. BRIGHT

Director, Environmental Control and Vehicle Safety

FORD MOTOR COMPANY OF CANADA, LIMITED

at the

Ontario's Energy Choices Conference

Sheraton Centre Hotel, Toronto

April 4, 1989

Ontario and Canada have always been blessed with an abundant energy supply base, which includes the two normally thought of transportation fuels, diesel fuel and gasoline. Due to forward thinking programs and policies of both present and past governments, Ontario has multiple choices for alternative fuels in the future, since a solid base is in existence on which to build or direct future alternative fuel development. These choices include the presently available fuels of propane and natural gas for vehicles and will include methanol and possibly ethanol in the very near future.

While this multiple choice situation may be thought of as inhibiting the development of future policies and as a detriment to focusing attention to a specific alternative fuel, this should not be the case. I believe that there is no single 'best' alternative fuel for the future but rather that niche markets will develop for many of them. We do believe, however, that in the longer time frame, methanol will become the third most used future fuel and gradually move up the scale as petroleum based fuels become more scarce and expensive. This belief is based on several factors including environmental issues, activities in the United States, fuel efficiencies, resource availability and the ease of working with liquid fuels over gaseous on both the vehicle and in the original equipment manufacturers production facilities.

of our vehicles. While this certainly limits propane from being the sole universal fuel, which I have previously suggested probably will never exist anyway, it does provide for a potential seven-fold increase in vehicle population from where we are now. Since the refuelling infrastructure is already in place, propane would appear to have a position in Ontario's energy choices. Whether we would have the incentives either 'real world' in terms of shortage and price or deliberate in terms of subsidies remains to be seen. However, the choice per se is real.

Turning now to NGV or natural gas for vehicles, many of the factors applicable to propane are the same, if not on a much reduced scale. A recent development underway at ORTECH International (formerly Ontario Research) and sponsored by both government and the gas industry may assist both NGV and propane. This project is developing a gaseous fuel injection system which will enable gaseous fuelled vehicles to compete more effectively with gasoline than in the past. While the application of NGV to date has been small, the development of the GFI system and a future home compressor option would appear to keep NGV on the list as a current and future energy option for Ontario.

I would now like to look at the alcohols as future options, and in the case of methanol, perhaps not very far in the future. The developments in alcohol fuels were first driven by gasoline shortages and now by environment concerns, particularly in certain sections of the U.S. Methanol is being presented as the front running alcohol, primarily

I would now like to take a brief look at the most probable alternative fuels to review the benefits, some potential problems and to support our case that they might be a part of Ontario's energy choices.

The first alternative fuel, of course, is propane. Propane is the most widely used alternative fuel in Ontario and across Canada. A dedicated vehicle, that is one fuelled solely by propane, can be driven across Canada with no fear of fuel availability, since there are now an estimated 5,000 outlets in Canada for refuelling. The development of propane as an alternative fuel is a success story due to cooperation between government and industry, and Ontario played a large role in its development. While it remains an aftermarket development, all of the automotive manufacturers had programs in attempting to provide a factory produced vehicle.

Unfortunately, both interest and support have eluded us in being able to generate volumes large enough to sustain a factory produced light truck or passenger car. In our situation at Ford, we are still offering a medium/heavy truck model fuelled by propane and a light truck prep engine which is modified to assist in the conversion to propane.

Propane is the fuel of choice for many police, taxi and other fleets with an estimated 140,000 vehicles on the road in Canada who enjoy typical savings of 20 to 30 per cent. All fuels have certain advantages and disadvantages. One disadvantage cited for propane is the absolute limit to the supply side. It has been suggested that perhaps enough propane could be supplied to the transportation section to fuel only 10 per cent because of fuel production costs and potential supply. The supply base now is natural gas with a future potential of using coal. This alone projects availability several hundred years into the future on a pure availability basis. While neither methanol nor ethanol are available at the local service station yet, except perhaps as low blends with gasoline in certain areas of the country, much research and action is underway. The major manufacturers will probably be supplying low production volume vehicles to California in the early to mid 90's in either dedicated or flexible fuel form. At Ford, the flexible fuel vehicle project has been near and dear to my heart for the last several years. The Ford flexible fuel vehicle will run on any combination of gasoline, methanol and/or ethanol from a single fuel tank, without any action on the part of the driver.

The heart of the FFV concept car is an optical sensor in the fuel system. The sensor in effect shines a light through the fuel and by measuring light refraction, establishes a voltage for each fuel mix. The voltage is then fed to the on-board computer which in turn alters the engine parameters of air/fuel ratio, ignition timing and exhaust gas recirculation to suit the fuel mix being used. The mix can vary from M85 (85% methanol or ethanol/15% gasoline) to 100 per cent gasoline. The final fine tuning of the air/fuel is done by the oxygen sensor, as on gasoline fuelled vehicles.

I have now driven a research FFV prototype vehicle for the last 2-½ years and have almost 80,000 Kms on it. It's one of a Canadian 19-car fleet program using the LTD Crown Victoria with a sequential EFI 5.0-litre engine.

The program is primarily backed by Ford with assistance from Shell Canada and funding assistance from the federal Energy Mines and Resources, Ontario Ministry fo Energy and New York State. Two of the vehicles are operated by St. Lawrence Starch and are fuelled by ethanol/gasoline mixes.

Historically, alcohol vehicles list two problems. Difficult cold starting and material compatibility. The material problems are basically behind us.

This vehicle has a unique cold start system which has started consistently in five seconds at temperatures as low as -28°C (-20°F). We believe it is truly a breakthrough in cold starting technology with methanol. Our actual favourable 'on road' starting experience with nine cars in Oakville over the last three winters appears to verify our starting system.

As some of you are aware, ethanol from sugar cane is a large part of automotive fuel in Brazil. Ford's long experience in Brazil with ethanol coupled to our North American research and development program in methanol allows us to believe that methanol and perhaps ethanol will play a large role in Ontario's automotive future. Consequently, I must place these fuels high on the list of Ontario's automotive fuel choices in the future.

Over the last decade or two, many potential automotive alternative fuels have been studied at Ford, with major research programs on propane, compressed natural gas (NGV) liquified natural gas, ethanol, methanol and electric vehicles.

I believe that propane, NGV, methanol and perhaps ethanol have the potential to have significant roles in Ontario's energy choices.

The alternative automotive fuels that remain or become significant in the future will be those relating favourable to environmental and economic considerations based on the future supply base for these fuels. In addition practical considerations will also dictate that decisions made by our biggest trading partner, the U.S. must be factored into our alternative fuel decisions.

In any event, Ontario is in a very favourable position in that there appears to be multiple automotive alternative fuel choices including many which will contribute to the security of the automotive fuel supply.

PERSPECTIVES ON BIOENERGY

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Alternate Energy Choices
Ontario's Energy Choices Conference
April 3 - 4, 1989
Toronto, Ontario

INTRODUCTION

The term Biomass is used to refer to all living or recently dead plant or animal material. These biomass materials, including; wood and other tree derived components, agricultural crops and crop residues, food processing wastes, a large portion of municipal and industrial solid wastes, and even peat, are classed as Biofuels and can be utilized for the production of Bioenergy as thermal, electrical or mechanical forms.

Within Canada, a sustained program of energy diversification during the recent energy crisis decade encouraged a significant increase in the overall contribution from bioenergy. From about 3 percent of primary energy supply in 1978, bioenergy has been increased to a present level of at least 7 percent, and very probably about 9 percent. This is roughly half the contribution from coal, but more than double the current output from the nuclear industry.

Within Ontario, bioenergy is a much less significant component. Ontario supplies roughly 21 percent of total Canadian bioenergy but this represents only about 4.5 percent of Ontario energy demand. This level of penetration is higher than for the prairie provinces which derive only about 2 percent of their energy from biomass but much lower than the Atlantic provinces where 12 percent of primary energy is biomass derived, or of BC where 23 percent is bioenergy. In Ontario, as in most regions of Canada, a substantial, sustainable biomass resource is available for an expanded energy supply without compromising production of food or traditional non-energy biomass derived products. A strong financial incentive could easily double the bioenergy contribution based on existing technology and resources, while a sufficiently large land base exists to theoretically provide up to about 75 percent of Ontario energy demand from biomass.

THE RATIONALE FOR BIOENERGY

Any superficial examination of the overall Canadian energy situation would suggest little justification for significant involvement by Ontario, or any other region, in an alternate energy technology such as Bioenergy. Traditional energy resources are substantial, including:

* crude oil; Canada is a net exporter of crude oil. Conventional offshore and frontier supplies have been identified and are under development. Commercial production of oil from the tar sands is on-line.
* natural gas; Canada is also a net exporter of natural gas with a short-term surplus and identified reserves more than double that of crude oil.
* hydroelectric; The worlds largest producer of hydroelectric energy, Canada, has a short-term production overcapacity and significant undeveloped hydro potential.
* coal; Canada has large coal deposits with an identified economic reserve sufficient for 100 years at the present rate of production.
* nuclear; Canada has significant uranium deposits, is a world leader in uranium production, and has a strong nuclear industry.

On the other hand, Canada has been very active in research, development and implementation of alternate energy technologies of which bioenergy is the major component. This involvement is based on a number of considerations including environmental, socioeconomic and financial.

ENVIRONMENTAL

While indiscriminate large-scale use of biomass for energy can have severe negative environmental impact (for example, complete deforestation in tropical countries leading to severe soil erosion), the rational implementation of bioenergy in a controlled society such as Ontario, can have substantial positive environmental benefit through both fossil fuel substitution and industrial waste utilization.

Use of renewable biofuels reduces the release rate of locked-up carbon in fossil fuels, the main factor causing the current buildup of atmospheric carbon dioxide and the resultant greenhouse effect. Biofuels are low in sulphur content, reducing the potential for acid rain. In addition, increased bioenergy use means reduced environmental degradation resulting from energy megaprojects in the traditional sector (strip mining for coal, flooding for hydro reservoirs, arctic oil spills, etc.).

Of greater short-term benefit is the direct contribution to a sustainable environment resulting from the disposal of industrial waste streams. The controlled combustion of solid residues (industrial wastes, forest industry residues, MSW) reduces pressure on landfill sites while the anaerobic digestion of sewage and industrial aqueous effluents provides an effective means for COD reduction plus a clean burning gas to displace fossil fuels.

With respect to forest operations, the production of fuel chips from low-quality non-commercial residuals and logging slash provides several benefits. Eliminating open burning of slash piles directly reduces air-pollution; the salvage of dead, diseased and cull stands plus the removal of heavy slash concentrations provides an improved site for replanting thus promoting rapid forest re-establishment on logged-over areas; and fuel chip sales provide revenue to support more intensive silvicultural treatments and generally improved forest management.

SOCIOECONOMIC

While Canada has abundant reserves of fossil fuels they are often concentrated in specific geographical areas. When the regional economic situation is considered, the net social benefit of a local bioenergy project often outweighs the simple financial savings obtained by purchasing conventional fuels from another region or province. Bioenergy projects provide local employment, keep the fuel dollars within the region, and contribute to overall rural revitalization. The typical bioenergy projects are small to medium scale with short lead times that provide much greater flexibility than do megaproject fossil fuel energy systems, and the greater diversity of energy supply means that local bioenergy users cannot be held hostage by foreign (out of province) energy suppliers.

FINANCIAL

In many cases bioenergy systems are financially attractive on their own merits without any public subsidization. Where a local low cost residue fuel is available, if pollution abatement is required, or if individual involvement occurs, the return on investment is very good with paybacks often less than a year. Bioenergy is one of the few areas where a firm or individual can achieve significant energy cost reduction through personal labour input.

BIOENERGY TECHNOLOGIES

Several aspects serve to delineate bioenergy as a unique segment of the energy industry. One major factor is that biomass feedstocks are characterized by an extreme diversity in terms of raw material form. For example, they can be:

* high organic content aqueous liquids (pulping liquors, sewage);
* bulky, wet, dirty fibrous material (bark, MSW);
* dry, fine particulates (sanderdust, chaff);
* large solid blocks (straw bales, stovewood).

As a result, the technologies of bioenergy encompass a wide spectrum ranging from simple combustion of solid biofuels for direct energy release to complex multi-stage thermochemical or biological conversion processes that convert raw feedstocks to prepared fuels. The bioenergy envelope also includes technologies which convert biomass to chemical products that can substitute for hydrocarbon derived materials (thus releasing petroleum/natural gas from the petrochemical industry to the energy sector).

DIRECT COMBUSTION

Within direct combustion, the main component of bioenergy, the primary application is the industrial burning of on-site generated biomass residues/wastes. These combustors supply process energy based on use of a very low cost fuel that in many cases would otherwise represent a disposal cost burden. Specific major commercial examples are:

* combustion of black liquor in Kraft pulp mill recovery boilers;
* burning of bark/sawdust/shavings (hog fuel) in field erected or packaged boilers to provide process energy for lumber and veneer drying, pond heating, press heating, etc., in the primary forest

products industry;

* suspension firing of fine, dry, pulverized wood fuels for furnish drying in the particleboard and flakeboard industries;

* combustion of solid residues to generate steam in the food processing industries;

* in-house incineration of industrial wastes utilizing heat recovery boilers to provide process energy.

A second major area is in the direct combustion of delivered (purchased) raw biofuels. Specific examples include:

* energy-from-waste plants which generate process energy (and often co-generated electricity) through combustion of the organic portion of MSW;

* institutions (hospitals, schools, community facilities, etc.), which purchase locally available biofuels for their solid fuel fired boilers that provide space heating and often process steam;

* non-forest commercial or industrial plants (greenhouses, textile mills, brickworks, etc.), that have discovered the financial benefits of burning purchased residue fuels (or whole tree chips) for space/process heating;

* residential stoves/furnaces/boilers which use purchased roundwood or particulate fuels for space heating requirements;

* co-generation utilities which operate as separate entities that purchase biofuels and sell electricity and process steam.

A third general area is that of the recently developed prepared solid fuel industry. Raw biomass feedstocks are transformed into dry, uniform pellets (or briquettes/firelogs) which are delivered in bulk to industrial/commercial users or packaged for sale to small-scale/residential customers. The additional processing costs are recovered from customer benefits which include reduced transportation costs, higher burning efficiency, smaller storage facilities, and lower overall capital costs for the combustion system. This approach offers a practical system for longer distance transfer of the energy in raw biofuels, out of the local biofuel supply area to larger urban markets.

In general, the direct combustion of biofuels is already well established in the residential, commercial and industrial sectors. Increased market penetration should be readily achieved when rising fossil fuel prices will again improve the financial attractiveness of biofuel use. Other aspects that would improve bioenergy applications include:

* technical advances and larger scale production that would reduce capital and operating costs;

* development of a wider fuel supply infrastructure with established reputable biofuel dealers to ensure fuel quality standards and supplies;

* increased pressure within the forest sector to clean-up low-grade stands and logging residues to facilitate conversion of unproductive areas to silviculturally desirable, intensively managed forests;

* environmental pressure to utilize wastes rather than merely continue dumping.

LIQUID FUELS

Several liquid fuels from biomass options have been technically proven. These include:

* methanol - via oxygen or pyrolytic gasification plus synthesis;

- ethanol - via fermentation of sugars from hydrolyzed starch crops or from hydrolysis of cellulosics;
- fuel oils - via direct extraction from oilseeds or via direct thermochemical conversion including fast pyrolysis or solvolytic liquefaction;
- gasoline, diesel or transportation fuel additives/enhancers - via catalytic cracking or hydrotreating of biomass derived oils - via Mobil synthesis of biomass derived methanol, or via polymerization of olefinic gases pyrolytically derived from biomass.

Methanol

The oxygen gasification of biomass to produce a syngas suitable for methanol synthesis has been extensively investigated. Initial work by INCO in Toronto was carried on by several research groups and culminated with the recent BIOSYN test program of a 10 t/h pressurized, oxygen-blown, fluid-bed gasifier (based on the Ontario developed Omnifuel Technology).

While the technology is considered proven, the projected methanol cost estimates are significantly higher than the cost for producing methanol from natural gas or even from low-grade coal deposits. As a result, interest in methanol from biomass has waned since there appears to be little short-term financial justification for this approach.

Ethanol

Ethanol has been proven feasible under Canadian conditions as a strong contender for octane enhancement of gasoline required by the lead phase-down now underway. It has been marketed commercially both as a single blend and as a co-solvent with methanol.

Production of fuel ethanol from grain is technically proven and well established in the U.S. and Canada with costs governed to a very large extent by feedstock prices. Recent financial studies have shown that at the present time the production costs for new stand-alone fuel ethanol from grain plants are higher than the ethanol value as a fuel extender or even as an octane enhancer. The subsidy required for economic viability is relatively small, and social benefits (environmental considerations, support for agriculture, etc.), may justify the establishment of a fuel ethanol from starch industry in Ontario.

On the other hand, a large low-cost resource of lignocellulosic materials (wood residues, crop residues, etc.), can be utilized based on the acid or enzymatic hydrolysis of the cellulosic components to sugars for subsequent fermentation to ethanol. Acid-based processes are commercially operated in other countries (USSR, Brazil) but low yields, high capital costs and high operating costs generally indicate that acid hydrolysis processes are not commercially viable at present with little potential for significant future cost reductions. Enzymatic hydrolysis has been extensively researched and several newer processes developed to fractionate biomass prior to hydrolysis. These approaches hold the promise of potentially large cost reductions. The key, however, appears to be the development of a high value market for the lignin by-product. Considerable research work is being carried out in this area with technically interesting possibilities in adhesives and plastics or possibly as a feedstock for chemical upgrading to fuel additives.

Fuel Oils

Traditional slow thermochemical processing of biomass to yield liquid fuels (destructive distillation) resulted in a roughly equal split between char, gases and liquids. Recent research and development of fast pyrolysis processes have resulted in greatly increased liquid yields. By utilizing high heating rates, short retention times, and rapid cooling, primary biomass decomposition products can be trapped as liquids before secondary reactions can degrade them to char and gases. With this approach, liquid yields of up to 80% by mass can be achieved. This basic concept, pioneered in Ontario, has been developed to a 10-15 kg/h, semi-continuous, process development unit stage using both a blow-through fluidized-bed and a downflow transport reactor. The oil produced has a HHV of about 18 MJ/kg, contains up to 15% water, and has been successfully burned in standard pressure atomization oil burners. Research is underway to develop upgrading processes for conversion of these primary fuel oils to transportation fuels and fuel additives/extenders.

GASEOUS FUELS

Various gaseous fuel from biomass options exist, as technically proven, industrially demonstrated or commercially implemented. These include:

* biogas - via anaerobic digestion of aqueous organic effluent streams or in-situ landfilled MSW;
* manufactured gas - via air gasification of biofuels;
* substitute natural gas - via oxygen or pyrolytic gasification of biofuels or upgrading of biogas.

Biogas

At the present time, the value of energy in Ontario is sufficiently low that anaerobic digestion is not usually economically viable based only on the savings achieved from the displacement of fossil fuels. However, the combined benefits of energy production and pollution control often provide an attractive payback for digester systems operating on high organic content wastewater streams. These are primarily municipal sewage and effluents from large food processing plants including cheese factories, slaughter houses/meat packing plants, canneries, etc.

The traditional stirred-tank reactors are used extensively for digestion of municipal sewage but they typically have long hydraulic retention times, low organic loading rates, low rates of methane production and are prone to process instability and upsets. In an effort to improve overall performance, reactor designs were developed based on the preference of bacteria to attach to and grow on solid surfaces. The downflow stationary fixed-film reactor, developed by the NRC, utilizes vertically oriented surfaces of rough textured inert materials upon which a bacterial film develops.

These reactors are particularly well suited to wastewater streams with high dissolved organic content. They feature high loading rates and high rates of methane production without instability. Since the fixed-film medium immobilizes the bacteria, solid retention times are high, and the reactors adjust well to variations in influent quality and flow rate.

Manufactured Gas

The world's first, large-scale, commercial, fluidized-bed biomass gasifier was developed and demonstrated in Ontario, however, the availability of low-cost natural gas has prevented continuation of this promising retrofit application. Foreign suppliers have adopted this approach and several large gasifiers are fully operational, firing lime/cement kilns in Europe and the U.S. The technology is now commercially proven and available for implementation should future fossil fuel price increases make gasification financially attractive.

Substitute Natural Gas

Technically proven systems are available for production of pipeline quality substitute natural gas but even with virtually no-cost biomass feedstocks, the potential for large-scale, commercially viable, near-term implementation is remote.

SUMMARY

In the overall energy picture, bioenergy often has an image problem; it is perceived as unimportant, outdated, and of interest only to a radical fringe of social outcasts. In reality, bioenergy is a small but very significant segment of the diverse Canadian energy matrix. It is a widely established, industrially proven, commercially viable energy sector that supplies over 7 percent of Canadian primary energy demand. A sufficient biomass resource exists for a much greater use without, in any way, compromising traditional forest or agricultural production, often, in fact, complementing traditional resource harvesting through shared production costs.

New technologies now under development hold promise for the production of liquid fuel substitutes, natural gas substitutes and transportation fuels/extenders/enhancers from indigenous Ontario resources. They also open the door to production of petrochemical feedstocks from biomass, thus freeing up light oils for high quality fuel applications.

Bioenergy is not without environmental risk, but has many very positive aspects including the utilization of a wide variety of industrial residues/wastes and a lessening of atmospheric carbon dioxide buildup. It also has positive regional benefits such as local employment, rural revitalization, and provincial balance of trade improvements.

The major current barriers are low fossil fuel prices, lack of a strong fuel supply infrastructure and unrealized R&D in fundamental areas of multiple product development.

SOLAR ENERGY FOR ONTARIO

Presented by

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ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

Solar energy is a vast energy resource waiting to be tapped. This statement is as true for Ontario as it is for any other location on earth. The annual amount of solar energy incident on Southern Ontario alone exceeds Canada's current yearly energy consumption. In Ontario, studies conducted on behalf of the Ministry of Energy in the early 1980's indicated that solar energy had the potential to contribute 2% of the province's energy requirements by the year 1995. This equates to the energy required to supply one million single family dwellings.

Solar energy can and has been used in a multitude of applications around the world but those most relevant to Ontario include: building space heating and daylighting, domestic hot water heating, industrial process heat, pool heating, and electricity generation through photovoltaics. Each of these applications will be discussed in detail below.

Building Space Heating

Building space heating can be accomplished with two different solar strategies. One called "active solar heating" utilizes mechanical components with pumps or fans to circulate heat collection and transfer fluids. The other, "passive solar heating" is accomplished without the use of mechanical devices requiring parasitic energy.

Active Solar Heating

In the 1970's a number of residential buildings were constructed in Ontario utilizing active solar heating. As a result of this and other work, many of the mechanical components have been developed and system engineering is well understood. More research is required, however, to reduce the cost of components and installations and to improve the durability and reliability of systems. Since then, more cost effective measures, principally energy conservation and passive solar heating have made major advances with which active solar heating, with its high initial cost, can not compete. Few active solar heating systems are now being installed with the exception of an air based system developed by an Ontario company which is being actively marketed for commercial and industrial buildings. Although not currently in favour, technology improvements for active solar systems coupled with the reduced heating energy demands for residential buildings could see a resurgence of interest in active solar heating in the future.

Passive Solar Heating

It is generally agreed that passive solar heating is by far the most cost effective use of solar energy available today. Building design, orientation and site development are the main passive solar strategies. This, coupled with the new advances in window technology and integrated mechanical systems, means there is little reason why most new buildings in Ontario cannot derive a significant proportion of their heating requirements from the sun. In addition, many existing buildings may be retrofitted to achieve a higher degree of solar utilization. The only technical impediment lies in those sites which do not have adequate southern exposure.

Daylighting

Although often coupled with passive solar heating, but really technically distinct, is the concept of daylighting or use of sunlight to fulfill lighting requirements inside a building. For the most part, proper daylighting is also a function of the building design, however, a Canadian company has developed a "light pipe" which can channel daylighting to interior parts of a building. More must be learned about designing for daylighting but the potential for savings, not only in lighting energy costs but in reduced air conditioning requirements in larger commercial buildings, is significant.

Domestic Hot Water Heating

There are a number of domestic and commercial water heating systems installed in Ontario thanks, in part, to various government programs to encourage their use. These systems usually consist of collector and storage components and are installed to provide preheating of water. High equipment and installation costs have been the main impediments to more widespread use of these systems but recent technical improvements, including the microflow system developed at the University of Waterloo, have addressed both of these problems.

A major technical challenge for these systems in the Ontario climate, the solution to which adds to the capital cost, is the protection of the components from freezing. One response to this problem has been the development of "seasonal systems" which are designed to be used only during the times of the year when prolonged freezing is not prevalent. These systems are much less expensive to purchase and install and can provide a large percentage of hot water requirements during a major portion of the year. They are also ideally suited to use in summer cottages where freeze protection is not required. Although more improvements are desirable, there are no technical reasons why solar domestic hot water systems cannot be used in most parts of Ontario.

Industrial Process Heating

Technically, solar industrial process heating is very similar to domestic hot water heating only on a larger scale. Prime applications are processes which require low grade water heating (less than 100° C). Examples include vehicle washing facilities, photo laboratories and laundries. The larger scale of these installations improves the economics to a certain degree but the high capital costs are still a major impediment to more widespread use. There are a number of solar process heat applications in Ontario but most of these were the result of a subsidization program. As with other solar thermal technologies, no technical breakthroughs are required in this field but further improvements in cost reduction, durability and reliability are necessary

Swimming Pool Heating

Solar swimming pool heating is providing a cost effective alternative to many Ontario residents with backyard pools. Because of the low grade heat required, swimming pool collectors are relatively inexpensive to buy and install and they are tied into the pool circulating system so few other components are needed. When combined with a pool blanket, solar heating systems can extend the period of use of the pool from mid April to early October in most years in Southern Ontario. Solar heating systems for larger municipal sized pools can also be attractive but the components are more sophisticated and the systems must be engineered. The cost effectiveness will depend on the particular installation but, like many other applications, the high capital costs are a major impediment to more widespread use.

Photovoltaics

The conversion of direct sunlight to electricity is a technology that was originally exploited by the space program. However, over the past decade, much work has been done to develop terrestrial applications. The success of this work has led many experts to believe that photovoltaics is the solar technology with the most promise on a global scale. Although there is a major push to introduce photovoltaics in the third world, the aspects which make it attractive for this (ie no moving parts, system reliability) also make the technology suitable for many applications in Ontario. The first market here has been remote communications and navigation equipment where it is quickly becoming the technology of choice due to the low maintenance requirements. The next application receiving attention is the use of photovoltaic systems in combination with diesel generators for the provision of electricity to off-grid communities. The high initial cost of photovoltaic equipment precludes, for now, its further use in Southern Ontario where the utility grid is extensive but the prospect of the roofs of houses being covered with photo cells is more than a gleam in the eye of many photovoltaic proponents.

Challenges to the Further Use of Solar Energy in Ontario

In spite of the technical successes achieved in solar energy, the concept has suffered from some of the universal problems facing renewable energy today for which there is no single source of blame. Perhaps the greatest of these problems was the unrealistic expectations which were raised for solar energy. In the turmoil of the seventies, when energy supplies appeared to be scarce and prices appeared to be on a steep and continuous rise, many people were looking for any hope at all of relief and were willing to believe almost anything. Even those directly involved in renewable energy development, the majority of them well meaning, hard working individuals, had, perhaps, set their sights too high. After a while it became apparent that the goals that were initially set were unreasonable given the normal time frames for R&D, product development, industry start-up and the establishment of commercial infrastructure. Coincidental with this realization came the break in the oil price spiral with the prices on the world market not just levelling off but falling substantially. With the fall in the price of oil came a proportional fall in the interest to develop solar energy.

The most important barrier to overcome continues to be the high initial cost of most solar systems. This challenge can be met in two ways. The first is through continued research to reduce the costs and improve the efficiency of the components and systems. The second is through the development of innovative financing schemes to make the purchase of these systems more attractive to potential buyers and investors.

Another challenge is to overcome the poor image the technology and the industry gained in the early 1980's. At that time many systems in the field failed and were subsequently not properly serviced and repaired. Consequently, many of these systems are no longer in service today and the owners are disenchanted. The fact that the systems failed was not really surprising. A new technology was being developed and commercialized by young companies. Due to the pressure of the time, many of these systems were placed in the field before they had received adequate development and testing. When the systems did fail, there was not enough capability in the undercapitalized industry to provide adequate service and follow-up. Future work must concentrate not only on technical development but on the building of a proper industrial infrastructure.

From a broader perspective, perhaps the greatest challenge to increased use of solar energy is to regain the momentum of the 1970's. In the hiatus of the 1980's, the solar energy community has suffered a great deal. Government support has virtually disappeared, many researchers and others have been forced to find work in other fields, many companies have not survived, and Canada has lost much of its technical leadership. This impact has been felt more in Ontario than in other provinces because much of the activity was centred in this province. The provincial government led all other governments in support for solar energy development. The loss of commitment by Government of Ontario over the last few years has been one of the contributors to the current state of affairs.

These challenges can not only be met but they can be overcome with the requisite commitment from both the private sector and governments. But why should effort be expended to this end? There are two rather compelling reasons. The first is the reason that drove the initiatives in the seventies - the world's reserves of conventional energy sources are finite and some day we will run low. The timing of the condition of real scarcity is unclear but it behoves us to develop alternatives now in a rational manner rather than in response to a crisis situation in the future. The second reason is tied to what appears to be the emerging issue of the 1990's - the environment. It is becoming increasingly clear that the consumption of conventional fuels is having devastating effects on our environment. There is an increasing call to supplant these fuels wherever possible with solar and other renewable energies as quickly as possible.

So what is the future for safe, clean and sustainable solar energy in Ontario? That remains to be seen. The technology is here but it will take a political will to realize its vast potential.

THE NON-UTILITY GENERATION OPTION

Presented by

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ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

Precisely two years ago in this city, I spoke at a "Cogeneration and Parallel Electric Power Generation" conference on the topic of public policy issues and policy options.

At that time, private power - or, non-utility generation as it is now known - was still in what could be described as the "early innovation" stage. That is, the projects that were proceeding were often the result of entrepreneurs proceeding on a high risk basis in the hope that Ontario Hydro's purchase rate would soon improve, or that they could survive for a few more years on Ontario government programs.

In fact, at that time, with the exception of a municipal solid waste plant, a biomass plant and a wood cogeneration facility, all private power in what I would describe as "the modern era"* was small hydro - mostly the result of Ontario's small hydro encouragement program.

And while the fact that the Ontario government was providing support programs to so-called new energy source technologies was an indication of the government's, and in particular the Ministry of Energy's, support for these non-utility generation sources of electric power, I felt obliged to point out that industry could not survive on programs and that programs were only necessary in the face of a lack of government policy in this domain.

While some people expressed surprise at my remarks, a lot of water has passed under the bridge in the last two years. As a result of ongoing lobbying at both the bureaucratic and the political level - not to mention their own motivation - the Ministry of Energy has, for the past number of months, been putting the finishing touches on its non-utility generation policy. For this, the Ministry deserves credit and the industry players who so diligently persevered deserve credit too.

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* In the "modern era" I exclude very legitimate non-utility generation plants such as the Dow cogeneration facility in Sarnia which has been providing reliable power to Ontario since 1963.

And let me make one early comment on those industry players who have stuck close to this issue throughout. Many would-be non-utility generators, when they realized how slowly things were moving, decided not to stick around. Many others decided to keep their heads low in the naive hope they could negotiate a sweetheart deal with the utility. But a dedicated group of developers, economists, lawyers and financiers decided that if they weren't going to be able to deliver projects in the short term, they would set about to create the environment that would permit them to develop projects in the medium term. To the extent that this group is successful, it is to them that the late comers and the backroomers owe a great debt.

By the same token, just as the Ontario Ministry of Energy has helped advance the case of non-utility generation, so too has there been movement at Ontario Hydro. Despite an inherent conflict between the interests of non-utility generators on the one hand and greater Corporate Ontario Hydro on the other, there are those within Hydro who attempt to strongly advance the case for private sector power generation.

For our purposes, this help comes in the shape of the Non-Utility Generation division. This group, under the leadership of Paul Vyrostko, has accepted some basic principals of private power which a year ago, I would not have thought likely and I want to congratulate them. I am especially pleased with the 1989 time-differentiated rates.

Still, lest we think we can assume fast progress toward the building of actual projects - which, after all, is the primary motivation for being here - it should be pointed out that much yet needs to be accomplished.

For, just as the major issue facing non-utility generators in 1987 was one of policy, so today, in 1989, the major issue - and the major impediment to large scale project implementation - remains one of policy. Perhaps this in itself is one of our difficulties as an industry - so few people think in policy terms. Projects and programs on the other hand are much easier to get a handle on.

So let me explain why policy, and thus ultimately politics, is still the issue of the day and why, if you hope to build private power projects, you'd better understand what the policy implications are. Let me proceed by process of elimination. Assume that the question is "why are private power projects not proceeding at a pace which industry feels is achieveable".

Certainly we do not have a resource issue. We know that the resource for both small hydro and cogeneration is abundant. In fact, assessments of the resource put it far in excess of Ontario Hydro's needs over the utility's current planning horizon.

My own figures tell me we are looking at something in the 300 - 500 MW range for small hydro and over 3000 MWs in gas cogeneration to the mid-1990's. Notice that does not include several hundred additional MWs from wood cogeneration and EFW which are also players. For the period post-1995 we are looking at a further 4000 - 6000 MWs of gas cogeneration potential if and when it is needed. By the early part of the next century, advances in technology will further extend the opportunities for cogeneration. So the availability of resource is not in question.

Neither do we have a technology issue. The know-how and the hardware for the reliable generation of electric power from small hydro and cogeneration has been around for several decades. No-one disputes that falling water turns turbines, or that gas or wood fired boilers can generate both heat and electricity. They are doing it now.

In fact, they are doing it so well in the U.S. that Ontario industry better start to wonder how it is going to remain competitive. To the extent that energy is a cost factor in finished products, the more inefficiently we use that energy, the less competitive we will be. This should be a particular concern in the free trade environment.

Similarly, we do not have a financial issue. Two years ago I spoke about the millions of dollars of private investment money that was available for private sector generation projects. Since that time the situation has only become "worse". Why do I say "worse" when what I mean is that even more money is available for private sector power investment now than it was two years ago? Because since so few projects are proceeding, this money is going elsewhere and it may be a while before it comes back again. It is a particularly pecular province when, as happened to me one month ago, I was approached by a large Canadian investor that wanted to put $900 million into private power and I had to tell them to go cool their heels.

Finally, what we have is not an issue of bureaucratic indifference. Quite the contrary. We all know the Ontario Ministry of Energy supports an increasing role for non-utility generation in the province. As such, in the absense of political movement, the Ministry has devised a number of small hydro, wood energy, and cogeneration encouragement schemes to promote a sector that, in the early years, would otherwise have had no projects whatsoever. Also, as I have just noted above, the Ontario Ministry of Energy is devising its non-utility generation policy at this very time.

So if the explanation for the halting evolution of non-utility generation in the province of Ontario is not resource, technology, finance or government program related, then what is it?

Oh, you say, we've looked at cogeneration and based on what Hydro has told us the problem is it's not cost effective. Therein lies the rub. And unfortunately, many project proponents have gone no further than to accept Hydro's analysis of the situation.

That's where we get to the final issue. What's cost effective and what is not looks, on the surface, like an economics question. But ultimately it is a political question, ultimately it is a question of government policy.

Why is economics a question of politics?

To answer this question, stop thinking about your specific project for a moment and remember what the concept - and thus the widespread implementation - of private power is going to do.

Private power in aggregrate will:

- introduce competition to the electric generation market place;
- tap new sources of risk capital;
- shorten lead times for new projects thus lowering needed reserve margins as new facilities more closely track load changes;
- enhance the use of so-called new energy source technologies such as small hydro and cogeneration;
- increase the flexibility and reliability of the generation system by diversification away from current generation options;
- add environmental benefits;
- lower public regulatory risk due to uncertainty of demand;
- lower overall transmission requirements and system losses.

Some of these advantages are very appealing to utilities. They are so appealing, in fact, that Ontario Hydro has integrated many of them into its current demand/supply planning strategy. But their appeal wanes considerably when they can offer so much resource and so much diversification as to jeopardize a very large component of Ontario Hydro's raison d'etre.

And that is preceisely why Ontario Hydro will embrace non-utility generation up to, but not including, the point where its own next central generation plant becomes redundant. How does Hydro ensure that its next plant - i.e., Darlington 'B' does not become redundant? By making the economics of such a plant look more attractive while simultaneously making otherwise cost effective private projects barely marginal.

And how does Hydro bias the numbers in its favour?

To begin they assume options such as gas to have high fuel costs or options such as small hydro to have high capital costs. Gas, for example, was eliminated as an option in Hydro's draft Demand/Supply Planning Strategy based on assumed 1988 fuel costs of $5.08/mmBtu. (Actual costs were closer to $3.00.) But more important are Hydro's assumptions on the nuclear side of the equation.

Here the biases include a 4 percent real discount rate (6 or 7 percent would be closer to acceptable), a capacity factor for nuclear plants of 80 percent (historical reality looks more like 73%), a plant life of 40 years (by Hydro's own admission, highly speculative), and capital costs considerably lower than Darlington 'A' (keep in mind that the $12 billion Darlington station was originally budgeted at less than $4 billion).

Based on these assumptions, Hydro tells us their avoided cost is something less than 4 cents/kWh.

But if these assumptions are wrong, and the cost to Ontario ratepayers for new power is closer to 7 cents/kWh, then non-utility generation will flourish and we could easily avoid the need to build more large central plant. Corporate Ontario Hydro may not see that as in its own best interest. But the real question, and the one which needs to be more broadly politicized, is what is in the best interest of the ratepayer?

Coming back now to your individual plant, you may be the victim of faulty economics. Then again, you may not. But you should at least be interested in knowing the real answer. (And if I may be so modest as to suggest you engage our firm to assess your project's economic viability based on Hydro's current contract offers.) You should understand that there is a second opinion on the cost-effectiveness of your proposed facility and, as I will conclude in a moment, you should push for a public resolution of those differences.

So what, in my view, is the political situation? Well, there are at least three points.

1) The Ontario Cabinet - with the possible exception of Bob Wong - does not see a sufficiently large voting constituency that warrants taking strong legislative action favouring non-utility generation. Whose fault is this? I alluded to it earlier. The fault is primarily with would-be non-utility generators. More and more of you have gradually begun to show your faces, but there are still too many that hope to stay in the backdrop until the going gets really good. My point is that without you, the going may never get good enough. Cabinet is heavily lobbied by Ontario Hydro and that lobbying is not to create a better environment for private power.

2) There is sufficient non-utility generation potential in Ontario to meet Hydro's forecast needs over the current planning horizon. We don't have to use it. Whether it comes on line or not depends on your recognition of the choices involved.

3) The choice is between just enough private power to permit new nuclear contruction to justifiably proceed, or the full potential of private power resulting in a scaling down of Hydro's nuclear committment.

In terms of what is best both for Ontario ratepayers and taxpayers, the choice is obvious. In addition to the advantages enumerated above, private power will increase the competitiveness of Ontario industry, create jobs in the communities where people already live, introduce technologies with lower overall capital costs than those Hydro constructs, and reduce the strain on the Provincial debt.

So what, in my view, should the Ontario government/OME policy on non-utility generation include?

In sum, I want to see first-come first-served, full avoided cost, standard offer contracts for an initial block of 3000 MWs to be offered in 1990. Proposals coming in after the first 3000 MW offering is filled should be deferred to the next offering thus preventing the initial 3000 MW target from becoming a limit.

As a starting point, contracts should not be negotiable (most of you have told me you can't "negotiate" with a monopoly in any case) and there should be no limit as to project size nor penalty for generation technology employed.

Hydro should not be in a position to examine the financial details of a proponents proposal. This is simply a way for the utility to control a project's rate of return. If there is concern about the financial capabilities of proponents of larger projects, financial criteria standards can be established, but arbitration on whether a particular developer meets these standards should not be the purvue of Hydro. Rates of return will differ by technology, by project proponent and by level of risk, and are the domain of the developer and his financiers. Early risk takers should be rewarded accordingly.

There should be no plan to go to "competitive bidding" in this first phase. Hydro has already stated they don't think there is enough non-utility generation out there to meet demand so it should therefore want everything that's offered. Bidding only proceeds when there is perceived non-utility generation in excess of what the utility says it requires.

The question of what constitutes full avoided cost should be referred to the Ontario Energy Board for resolution this summer and the OEB Act should be amended to give the Board authority over Hydro, if not in all matters relating to electric generation planning, then certainly with respect to non-utility generation.

This latter matter of OEB legislative authority over non-utility generation matters is where my earlier comment of the need for a growing political constituency is most relevant. The government is now contemplating amendments to the OEB Act. Are you able to come to a normal business relationship with Ontario Hydro? If so, you are a rare commodity. If, as many of you have told me, you cannot, now is the time to make your views known to the Premier, to Minister Wong, to your MPP.

Once the question of what constitutes full avoided cost is resolved to the majority's liking, the issue of legitimate contract terms and conditions - including interconnection standards - must be addressed.

And what will we accomplish by all this? Well for one, we should get some solid evidence on the table about the delivery capability of non-utility generators. Then we can stop arguing about numbers. If we ask for 3000 MWs and only get 1000, Hydro is vindicated and can proceed with its own plants, demand permitting. If we get more than 3000 MWs we will have some indication how much is out there. At the same time, the sooner we get projects up and running, the sooner we can do more than merely speculate about the technology mix, about project size and most importantly, by about 1994, about private power reliability.

Let me end on what may seem to some like an unfortunate note. but which I simply view as realistic. There will be project failures. Plan for it. Too often we expect everything to run letter perfect and when they don't, some begin to cast doubts. It is absurd to think there won't be some mistakes. some errors in judgement. some financial difficulties.

But the success of the non-utility generation industry will have to be judged on its aggregate track record over a period of time. Initially. in fact, because of the pressure to build Darlington 'B', we will have to be judged over a very short five year period. But even under these constraints, I am confident we will prove our engineering miscalculations and our cost overruns to be far less consequential than those of the central generation model, and our reliability to be far in excess.

NOTES FOR PRESENTATION

ON

HYDRO-ELECTION GENERATION OPTIONS FOR ONTARIO

BY

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FOR

ONTARIO'S ENERGY CHOICES
CONFERENCE

The Sheraton Centre
Toronto, Ontario
April 3-4, 1989

Good afternoon ladies and gentlemen:

On this "electricity options" panel, I have been asked to address the option of hydro-electric generation for the Province of Ontario.

Compared to other supply/demand electricity scenarios for the future, this subject has the appearance of being the easier alternative for evaluation. I will attempt to make it a bit more difficult, and in addition to discussing internal hydro-electric generation possibilities, I will also present and comment on the possibility of major hydro purchases from both the provinces of Manitoba and Quebec. Finally, I will conclude with some general and specific observations on Ontario Hydros Demand/supply Planning Strategy and preferred options for the future.

I.

A. HISTORY AND BACKGROUND -- HYDRAULIC GENERATION

First, if I may briefly review with you some past history on hydro generation in Ontario and its relative role over time in contributing to the electrical requirements of the people of this province.

As most of you are aware, hydraulic plants have provided, until the 1950's, almost all of Ontario's electricity requirements. With most of the large scale economic sites developed, Ontario Hydro turned at that time to fossil-fired generation and of course to nuclear generation in the 1970's.

Currently, as Table 1 shows, the utility operates about 68 hydraulic plants compared to eight fossil stations (six in operation and two mothballed) and five nuclear stations of which four are operational and one under construction -- for a total installed dependable peak capacity of 30,080 megawatts.

TABLE 1
ONTARIO HYDRO'S
Generating Stations

HYDRO-ELECTRIC STATIONS	RIVER	PLACED IN SERVICE	ACQUIRED	INSTALLED CAPACITY KILOWATTS
Abitibi Canyon	Abitibi	1933	1933	233 825
Aquasabon	Aquasabon	1948		40 500
Alexander	Nipigon	1930		65 250
Arnprior	Madawaska	1976		74 100
Aubrey Falls	Mississagi	1969		130 150
Auburn	Otonabee	1911	1916	1 875
Barrett Chute	Madawaska	1912		152 400
Sir Adam Beck-Niagara No. 1	Niagara	1922		414 650
Sir Adam Beck-Niagara No. 2	Niagara	1954		1 223 600
Pumping Generating Station	Niagara	1957		176 700
Big Chute	Severn	1909	1914	3 980
Big Eddy	Muskoka	1941		7 650
Bingham Chute	South	1923		810
Calabogie	Madawaska	1917	1929	4 000
Cameron Falls	Nipigon	1920		72 000
Caribou Falls	English	1958		76 950
Chats Falls (Ontario half)	Ottawa	1931		89 300
Chenaux	Ottawa	1950		122 400
Coniston	Wanapitei	1905	1930	4 095
Crystal Falls	Sturgeon	1921	1937	8 080
DeCew Falls No. 1	Welland Canal	1898	1930	31 900
DeCew Falls No. 2	Welland Canal	1943		115 200
Des Joachims	Ottawa	1950		360 000
Ear Falls	English	1929		18 625
Elliott Chute	South	1929		1 440
Eugenia	Beaver	1915		3 600
Frankford	Trent	1913	1916	2 600
Hagues Reach	Trent	1925		3 360
Hanna Chute	S. Muskoka	1926		1 120
Harmon	Mattagami	1965		129 200
Healy Falls	Trent	1913	1916	10 500
High Falls	Mississippi	1920		2 100
Hound Chute	Montreal	1910	1944	2 800
Indian Chute	Montreal	1923	1944	3 240
Kakabeka Falls	Kaministikwia	1906	1949	24 170
Kipling	Mattagami	1966		125 100
Lakefield	Otonabee	1928	1936	2 000
Little Long	Mattagami	1963		121 600
Lower Notch	Montreal	1971		228 000
Lower Sturgeon	Mattagami	1923	1944	6 400
McVittie	Wanapitei	1912	1930	2 250
Manitou Falls	English	1956		72 000
Matabitchuan	Matabitchuan	1910	1941	6 760
Merrickville	Rideau	1915	1949	840
Meyersburg	Trent	1924		1 800
Mountain Chute	Madawaska	1967		139 500
Nipissing	South	1909	1916	2 050
Ontario Power	Niagara	1905	1917	101 455
Otter Rapids	Abitibi	1961		171 800
Otto Holden	Ottawa	1952		205 200
Pine Portage	Nipigon	1950		128 700
Ragged Rapids	Muskoka	1938		7 650
Ranney Falls	Trent	1922		7 920
George W. Rayner	Mississagi	1950		42 300
Red Rock Falls	Mississagi	1960		40 500
Sandy Falls	Mattagami	1911	1944	3 495
Robert H. Saunders-St. Lawrence	St. Lawrence	1958		912 000
Seymour	Trent	1910	1916	3 150
Sidney	Trent	1911	1916	3 180
Sills Island	Trent	1900	1937	2 295
Silver Falls	Kaministikwia	1959		45 000
South Falls	S. Muskoka		1915	3 835
Stewartville	Madawaska	1948		153 000
Stinson	Wanapitei	1925	1930	4 000
Trethewey Falls	S. Muskoka	1929		1 600
Wawaitin	Mattagami	1912	1944	11 750
Wells	Mississagi	1970		203 300
Whitedog Falls	Winnipeg	1958		64 800

The nature of hydraulic generation has obviously changed over time. Currently about 22% of capacity is hydraulic, 35% nuclear and 45% fossil, as reflected in Table 2.

TABLE 2
Ontario Hydro's installed dependable peak capacity (%)

Generation Type	1977	1982	1987
Hydraulic	31	27	22
Nuclear	16	20	35
Fossil	53	53	43

Source: Ontario Hydro

Given the different fuel costs and operating characteristics of the system, energy production is considerably higher from the nuclear source and slightly more from hydraulic sources. This shows hydraulic generation currently at 25%, nuclear at 50% and fossil at 25%.

When the Darlington Nuclear Station, currently being constructed, becomes fully operational in 1993, (3524 megawatts) the Ontario Hydro generating facilities will total about 32,400 megawatts.

At that time, as reflected in Table 3, the capacity mix will be 20% hydraulic, 43% nuclear, and 37% fossil generation. Energy production reflecting the cost-efficiency of the nuclear plants, is forecasted to be 22% hydraulic, 61% nuclear, and 17% fossil.

TABLE 3
Ontario Hydro's generating capacity and energy production 1993

Generation Type	Capacity (%)	Energy Production (%)
Hydraulic	20	22
Nuclear	43	61
Fossil	37	17

Source: Ontario Hydro

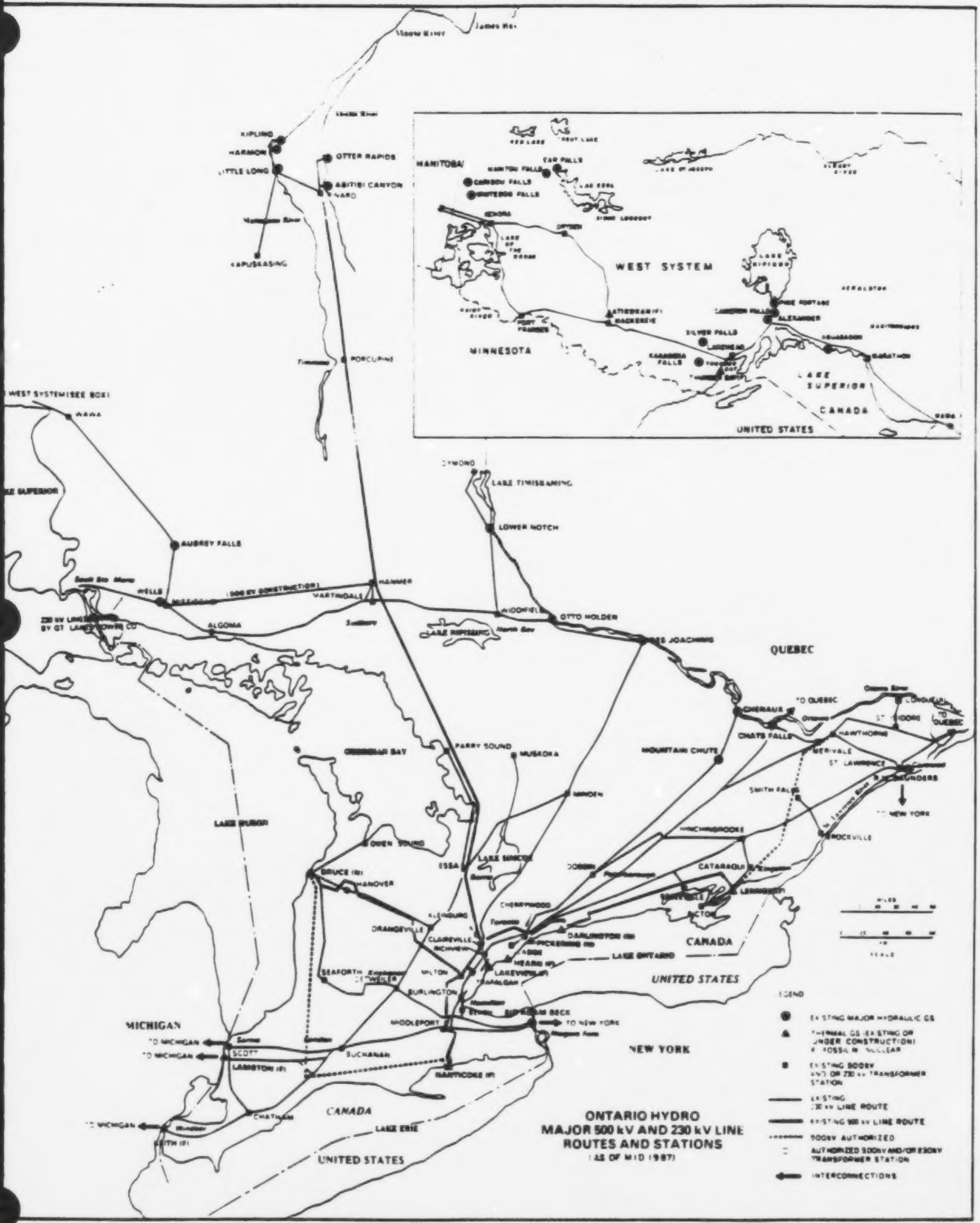
Energy production, of course, is not in proportion to the respective shares of system capacity, since the operating strategy is to supply electricity demand at the lowest cost, which means utilizing hydraulic and nuclear plants with the lowest operating costs first -- the base load -- and then more expensive fossil plants for peaking demand periods.

While hydraulic plants have had the lowest operating costs, most are limited in running continuously due to the inadequate water flows of Ontario rivers and smaller storage capacities associated with the demands of other water users -- such as recreation, fishing, transportation, etc.

B. FUTURE HYDRAULIC OPTION

The following diagram shows the total bulk electricity system -- generation, transmission and distribution facilities which provide electricity to Ontario citizens. (The round circle shows the location of existing major Ontario Hydro hydraulic generating stations).

DIAGRAM 1
ELECTRICITY SYSTEM
OF
ONTARIO HYDRO



ONTARIO HYDRO
MAJOR 500 kV AND 230 kV LINE
ROUTES AND STATIONS
(AS OF MID 1987)

Ontario Hydro has identified a theoretical potential of 9300 megawatts of undeveloped hydraulic electricity in the province. It has been concluded, however, that few sites are either economic (small amount of energy) or environmentally acceptable. This is due to:

- ► Protection of white waterway parks for recreation use.
- ► The environmental sensitivity of Northern rivers and their terrain.
- ► Unresolved native treaty land rights.
- ► The economics of development.

Based upon Ontario Hydro studies and other submissions presented to the Ontario Legislative Select Committee reviewing this area, there would appear to be only a limited number of significant remaining hydraulic sites available for development or existing sites available for major rehabilitation and increased developed capacity.

Approximately seventeen economic sites, mainly located in Northern Ontario have been identified by Ontario Hydro for such possible development in the next 20 to 30 years. The potential for implementation for the year 2000 has been estimated in the area of 1000 to 2700 megawatts, with an energy average of 250 to 700 megawatts (700 megawatts is roughly equivalent to the energy capacity of one Bruce nuclear station generating unit).

There are three specific areas where Ontario Hydro has commenced studies for obtaining developmental approval. These are:

1. Niagara

One of the original stations at Niagara Falls has been closed and another is nearing the end of its useful life. Accordingly, there is an opportunity to develop a new station several kilometres down river near Queenston which could provide the maximum benefit of the full drop from the falls and rapids. The installed capacity would be 532 megawatts with an average energy production of 116 megawatts; the planned in service date would be 1997.

2. Little Jackfish

Flowing into Lake Nipigon, the little Jackfish River has a small but fast water flow with an adequate drop for a dam and generating station. A number of studies have been commenced to obtain approval for construction and operation in 1993. The installed capacity is estimated at 132 megawatts with an average energy production of 65 megawatts.

3. Mattagami Complex

A number of hydraulic plants currently exist on the Mattagami river, flowing into James Bay from the south. It has been estimated that additional electricity can be generated from existing water flows. While a number of factors, such as water rights attributed to a private paper company, (Spruce Falls Power and Paper Company) would have to be successfully negotiated, then an estimated 379 megawatts of capacity with an average energy of 85 megawatts could be developed for implementation, according to Ontario Hydro, by 1994.

The above three sites are intended to provide approximately 1,000 megawatts of peak capacity and 250 average megawatts of energy upon completion.

The remaining 1,700 megawatts of the earlier mentioned projection of 2,700 megawatts that Ontario Hydro has identified that could be developed by the year 2,000 are located on eleven northern sites. The following table from the DSPS document shows all potential sites, (greater than 10 megawatts, with their installed capacity, average energy, and estimated standard cost to build and operate).

Standard Costs For Hydroelectric Options

Sites Greater Than 10 MW	Installed Capacity (MW)	Average Energy (Av. MW)	Standard Cost ($/MW.h)
Mattagami Complex	379	84.8	39
Niagara	532	116.4	42
Little Jackfish	132	64.9	44
Nine Mile Rapids	150	70.7	40
Long Sault Rapids	52	26.9	40
Abitibi Canyon	463	12.6	45
Patten Post	250	43.3	46
Otter Rapids	174	4.9	46
Ragged Chute	104	20.2	46
Maynard Falls	51	26.6	48
• Grey Goose	140	67.3	50
Ear Falls	15	5.4	50
• Grand Rapids	174	71.6	52
• Renison	135	63.3	55
Total	2750	679.0	45 (Avg)
Sites Between 2 & 10 MW	5 - 10	2 - 7	40 - 80

• Assessments have been based on very preliminary information and are subject to wide variation. More detailed site work would be required.

If we exclude the Niagara and Little Jack hydraulic locations, Ontario Hydro have in effect proposed the development of the Moose River Drainage Region, which if completely developed, would add an estimated capacity of 2,050 megawatts and 4,500 GWh of energy per year to Hydro's system.

The Moose River basin includes the Moose River itself as it flows into James Bay and its main tributaries -- the Mattagami, and Abitibi Rivers.

The proposal would be to develop about fourteen sites in the Moose River basin over a 30 year period time schedule. Six of these sites are underdeveloped with generation and transmission facilities in place and the remainder would be new sites for development.

As can be seen in the following diagram, the 14 sites included in the plan are extensions at the following generating stations:

Abitibi Canyon
Otter Rapids
Little Long
Smoky Falls
Harmon
Kipling

and new generating and transmitting facilities at:

Grand Rapids
Nine Mile Rapids
Blacksmith Rapids
Sand Rapids
Allan Rapids
Grey Moose
Renison
Cypress Falls

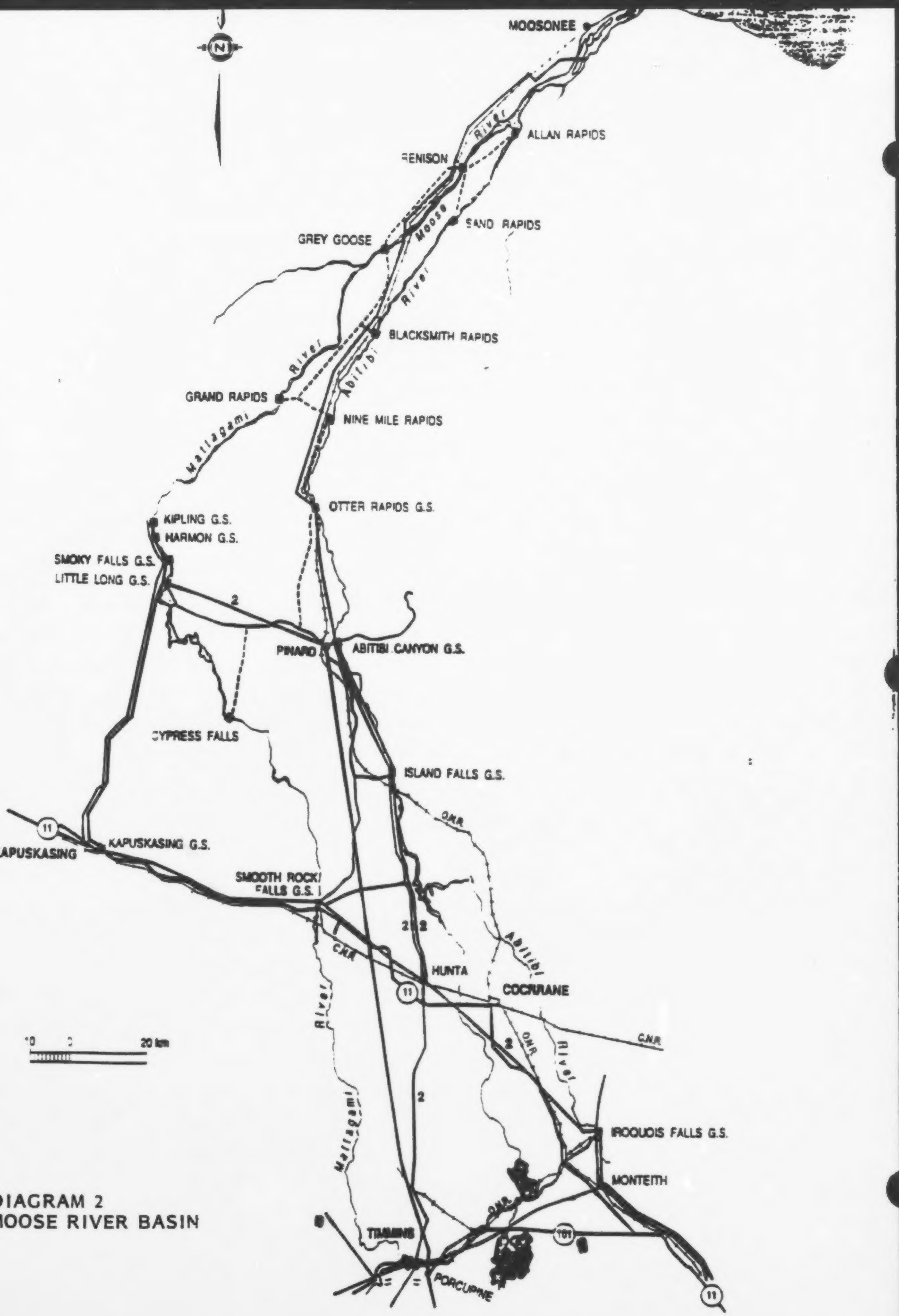


DIAGRAM 2
MOOSE RIVER BASIN

This proposal, if proceeded with, has tremendous opportunity to provide extensive economic benefits to the people living in Northern Ontario, especially those of Native ancestry. Training and employment opportunities and business spin off effects could be substantial.

The total direct workforce requirements have been tentatively estimated at about 25,000 person years with an annual workforce of approximately 1,000 persons by 1994, peaking around 1,300 by the year 2,000, and fluctuating around 1,000 until the year 2015.

The indirect workforce associated with the supply of equipment, material and services, applying a multiplier of 1.5 times the direct effort, would add another 40,000 person years of employment.

Thus, the opportunities for major northern benefits -- both business and employment, are immense. But these will only take place if there is a deliberate development plan which involves local northern communities and native groups to ensure that they are the major beneficiaries of such a hydro development plan.

In some respects, these are important parallels with the hydro development now taking place in northern Manitoba with the construction of a major 1,300 megawatt hydraulic station called Limestone.

In the past, hydro-electric development in Manitoba's North had been undertaken without any serious effort to maximize economic opportunities and improve the social and economic status of Northern residents. Following a systematic process of consultation with local people, a series of activities were established centered on:

i) The implementation of training and employment policies to assure a minimum degree of skill development and employment for Northern and Northern Native residents.

ii) New purchasing and tendering policies to provide increased opportunities for Northern and Northern native business.

Briefly, the results for the past five years has shown that nearly 3,000 northern residents, mainly of native ancestry, willhave received on-site or institutional training for apprentiship and journeyman credentials on a wide variety of skilled and semi-skilled occupations. Northern labour participation on the Limestone project has filled from 20 to 45 percent of labour requirements -- compared to less than 5 percent on previous projects. Moreover, the skills acquired are being utilized in community projects such as the construction of housing, roads, schools and hospitals, etc. Finally, new business contracts have been awarded to Northern and Northern native business firms as a result of the revised purchase and tendering programs, without any major increased costs for the project.

C. SUMMARY

Most conveniently available large hydraulic sites have been developed in Ontario over the last seventy-five years. While major development possibilities have been identified in Northern remote areas, their potential economic, environmental and social costs makes their construction unacceptable or extremely limited.

As a safe proven technology using a renewable energy source, hydraulic generation has to be an attractive option.

But environmental concerns, related to even limited land flooding, or changes in river flows, or transmission lines to connect to demand electricity centers, can effectively limit any further hydraulic generation role in Ontario.

If the above can be negotiated satisfactorily in the broad public interest with the associated trade-offs among competing objectives, further hydro development should take place. The few sites proposed by Ontario Hydro appear to be equal or less economic than current existing nuclear generating cost estimates due to the low energy capability of most remaining undeveloped locations.

However, it is claimed that the majority proposed are comparable to fossil plant estimates, and also provide the benefit of supply diversity and peak load operational flexibility. Moreover, the hydraulic plants proposed for the northern areas of the province provide local flexibility given the economic load situation in these areas.

I should emphasize that implementation of the above hydraulic plan will require a major effort by Ontario Hydro and Ontario government officials to ensure that some of the new hydraulic installations are developed in an environmentally acceptable manner.

Of equal importance though, a concerted action plan is required to involve local northern communities and native groups and associations to provide the maximum positive local economic business benefits and training and employment opportunities.

II

HYDRO PURCHASES

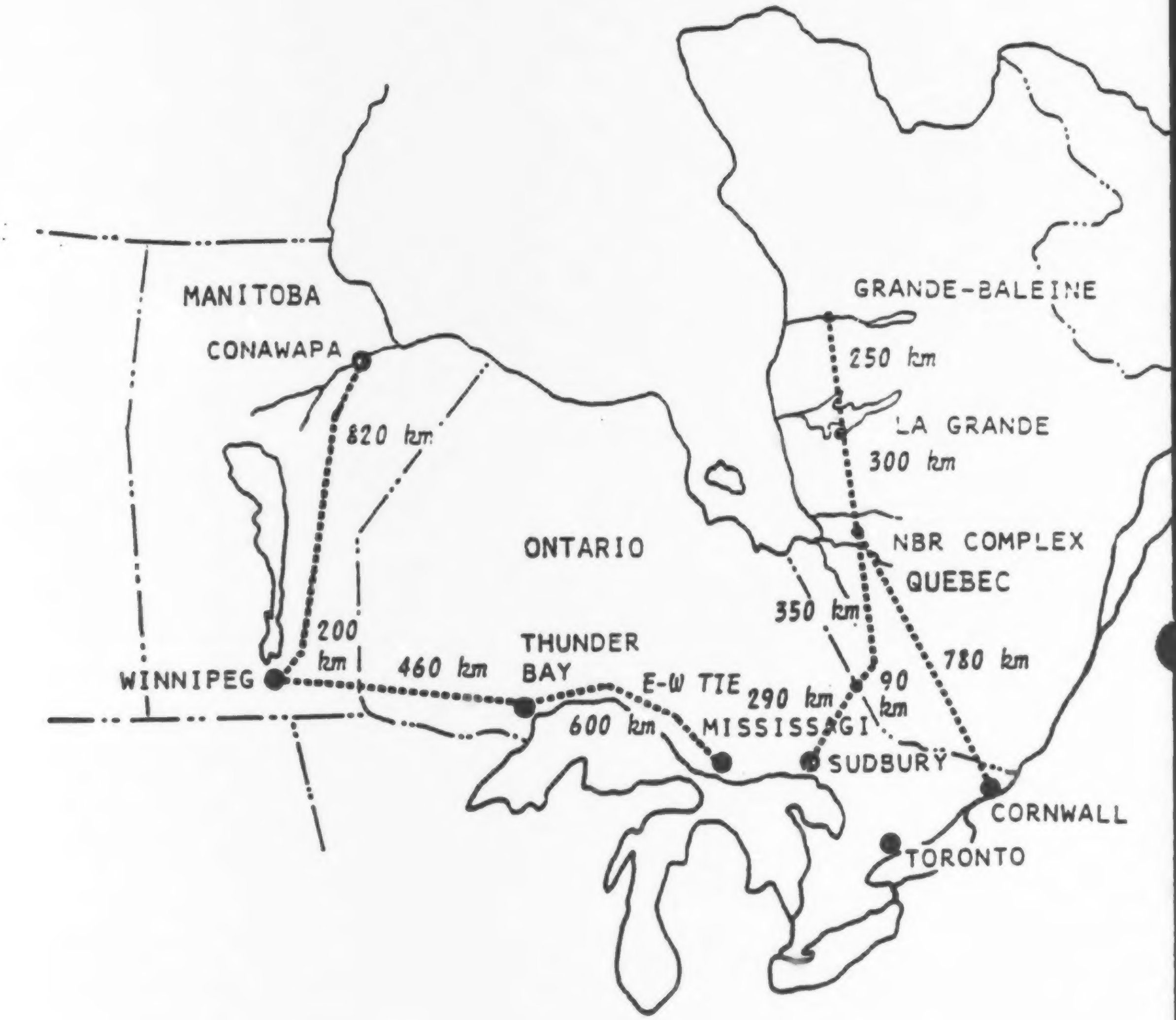
The Ontario Hydro DSPS document identifies and discusses the positive and negative characteristics associated with possible major purchases of hydraulic electricity from the provinces of Manitoba and Quebec.

In both scenarios, Manitoba Hydro and Quebec Hydro would have to build additional generating capacity for these large potential sales, since both provinces have no large surplus capacity from existing plant for export sale in the 1990's.

With Manitoba, a purchase of 400 to 1,000 megawatts for a period up to 35 years is currently being discussed and negotiated. A successful transaction would result in the construction of the next hydraulic station, called Conawapa, on the Nelson River in northern Manitoba as can be seen from the following diagram. The larger 1,000 megawatt sale would require new transmission facilities in Ontario, while the smaller arrangement would necessitate upgrading of the existing interconnections between the two utilities.

DIAGRAM 3

NEW TRANSMISSION REQUIREMENTS FOR PURCHASE OPTIONS



With Quebec, a purchase of 750 megawatts to 4,000 megawatts is being discussed for similar time periods. If successfully negotiated, the result would require new hydraulic generating capacity being built in any one of three areas shown in this diagram.

(a) NBR complex -- Nottaway, Broadback, and Rupert Rivers.

(b) Le Grande River near the existing James Bay project.

(c) On the Grande Baleine River.

As in Manitoba, except for the smaller 750 MW option, all other larger sales would require new transmission facilities in Ontario.

While specific aspects of these proposed arrangements can be discussed in the abstract, hopefully the bottom line for each respective utility is whether the price is right and whether each utility representative can walk away from the bargaining table with a smile on their respective face.

Clearly, I declare my bias in these possible arrangements. I negotiated a number of major electricity export sales for Manitoba Hydro, including a 200 megawatt sale with Ontario Hydro scheduled to commence in 1998. From my own analysis, I believe there are sufficient benefits for both sides to share economically in such electricity transactions.

The history of utilities operating in their respective provincial jurisdictions in Canada has not recorded a satisfactory performance over the years in implementing east-west electricity grid systems. The benefits of such interconnections have been well documented by utility engineers, from increased reliability and emergency support to improved system planning and lower cost in operations.

Regretfully, the lack of success in my judgement has not been due to economics but towards an old utility notion of imperialism and "maitre chez nous" on internal electricity generation. Happily, some of those barriers are now breaking down.

Given the large and extensive undeveloped hydraulic potential available both in the provinces of Manitoba and Quebec -- the economic theory of comparative economic advantage should be allowed to operate.

III

GENERAL -- ONTARIO HYDRO'S DEMAND/SUPPLY PLANNING STRATEGY

I now would like to make some brief concluding remarks on Ontario Hydro's Demand/Supply scenarios and possible options for the future.

1. First, it is important to acknowledge that Ontario Hydro's past performance in carrying out its mission of providing safe, reliable, and economical power for the people of Ontario has been good. Not withstanding a lack of indigenous resources, such as abundant low cost hydro found in other Canadian provinces, the utility has managed to implement an electricity rate structure for residential and industrial consumers that compares favourably both among utilities in Canada, and in other parts of the industrial world.

In addition, Ontario Hydro's reliability record in ensuring that residents of Ontario receive their electricity without major blackouts, or brownouts has been very favourable.

What most have taken as given in the past will pose great challenges for the future. It is clear that the availability of electricity, its reliability and the stability of the rate structure, will be subject to increased pressures and considerable uncertainty.

2. A large part of that uncertainty relates to the positive, new and enhanced role of environmental considerations related to energy developments. There is a broad consensus today that energy development and use must include a responsibility to both, minimize negative impacts, and avoid significant irreversible damage to the environment.

What is not clear is how to formulate and manage the choices and trade-offs among the various ways in which energy is generated and consumed.

For example, the underlying patterns of consumer behaviour are deeply rooted and are resistant to change. If it is the objective, it is not yet clear how the transformation from a "consumer society" to a "conserver society" will occur. Obviously, this will depend on active policy intervention as well as future technological innovation, since energy efficiency has to be more than letting the existing so-called market system take its course.

The degree of intervention can range from establishing mandatory efficiency standards for appliances -- which may be acceptable -- to rationing available electricity supply, by time, region and user -- which may not be acceptable.

3. It is clear that Demand management, conservation and energy efficiency should be important and major components of Ontario's future electricity system. It is less clear what can be attainable over a short time period and the type of incentives required to impact electricity consumption patterns and characteristics, and whether those incentives will be successful.

Ontario Hydro have established a minimum target of 5,500 megawatts to achieve in this area. Since new major supply sources -- even if desirable -- cannot be available until the year 2000+, this demand management goal must be implemented to maintain system reliability in 1990's.

From my own experience in a number of active energy conservation programs in the Province of Manitoba, I believe that these goals will be difficult to achieve. The incentive demonstration programs may certainly be more costly than the original estimates, while mandatory energy efficiency plans for appliances, street lightening, etc. may take more time in implementation because of the necessary consultation among producers, municipal utilities, etc.

4. My own conclusion on all the energy options considered in the Demand/supply Planning Strategy by Ontario Hydro, is that there will be a requirement in Ontario for an additional major supply generating source in the next 12 to 15 years.

If one evaluates:

- ► The long lead times required to plan and implement a major generating sources, and,

- The limited ability to impact consumer behaviour activity in the short run, together with a very substantial demand management program proposed for implementation,

then approval must be given to commence the planning for a new generating plant within the next one to two years.

This scenario assumes the go-ahead of the limited hydro potential available in the province, the approval of major electricity purchases from Manitoba and Quebec, as well as the proposed purchases from independent generation and co-generation.

Presumably, the decision making process could be extended one to two years more, on the understanding that, if required, alternative supply sources could be installed, such as natural gas turbines, but perhaps, only at tremendous cost. Short-term power purchases could also be considered -- if they were available at that time. As noted though, both Manitoba and Quebec currently have no such surplus sales to make and utilities in the United States, particularly on the Eastern seaboard, are forecasted to be in a much more difficult demand/supply condition in the early to mid 1990's.

***

Thus, in my judgement, one may gamble and be lucky, and buy a short period of time. But the alternative to not commencing to build a new major supply generating source for the future, is to draw up systematic plans for possible power rationing for Ontario's consumers and industries.

Thank you very much for your time and interest.

ELECTRICITY OPTIONS

Presented by

Robert C. Franklin
Chairman and President
Ontario Hydro

PLENARY PANEL ON ELECTRICITY OPTIONS
ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

Over the course of this conference, the discussion of future energy needs has narrowed down considerably, going from a world focus to this final panel on electricity options for Ontario.

Some of the discussion has centered on theory, and some has dealt with very specific applications of the economic, environmental and social principles which will likely steer our course in the future.

But it has been much more than a simple exchange of ideas, important though that is. What has struck me, and I'm sure many of you, is the note of urgency that is now being attached to tackling tomorrow's needs today.

From my perspective, nowhere is that note of urgency more audible than in the electrical energy sector, in Ontario. And I don't think I'm overdramatizing to say that, for Ontario Hydro, the time for making decisions about the future is now.

Tomorrow's reality, by definition, won't be known until tomorrow. So we have only our perception, our best estimates, to tell us what the future holds. And it is on that prediction or forecast that we have to make our plans for tomorrow, and start to implement them today.

We are now in a critical planning stage -- both for Ontario Hydro and for Ontario -- as we face a somewhat uncertain future. I say somewhat, because we can make some basic assumptions about electricity use in Ontario over the next couple of decades.

For instance, we know that in order to meet the expectations of society, the production of electrical energy will have to be carried out with the least possible impact on our environment. As an industry, we are not alone in this regard. It presents all of us in the energy sector with one of the great challenges of our time.

We also know that reliability of our product is of paramount importance to the electrical energy user -- from the homeowner to the industrial giant. But it is reliability that goes far beyond the traditional meaning of making sure the lights stay on.

A new standard of reliability will be required to meet the exacting demands of the new computerized systems and other sensitive electric equipment, which are less forgiving of any fluctuations in the voltage level. Combined with the existing interruptible power option, they will provide our customers with a range of electricity choices.

At the same time that we monitor and minimize our impact on the environment, and improve the reliability of supply, we are still expected to maintain the low price of electricity that Ontario has enjoyed since day one at Hydro back at the beginning of this century. In fact, electricity prices have fallen in relation to other prices, and today, Ontarians have to work far fewer hours than they did 60 years ago to buy the same amount of electricity.

Those three factors -- the environment, reliabilitiy, and low cost -- are three of the fixed variables we have to operate within. But we know a good deal more.

We know, for instance, that without our ambitious energy management and non-utility generation programs, our current generating capacity could be reached by the mid-1990s. During the economic boom of the past five years, we have seen a dramatic increase in Ontario's power use, an amount equal to our new Darlington nuclear station's 3600-megawatt output. Therefore, Darlington won't provide much of a buffer for meeting new demand beyond 1994, when it is in full operation.

So that weighs heavily on our minds as we look ahead. But we have been preparing for that eventuality since 1984, when we started the most comprehensive planning study in Hydro's history.

It started out simply enough with the intention of identifying how Ontario's future electricity needs would be met. But changes in the social, environmental and business climates over that period have had a dramatic impact on our outlook.

The Demand/Supply Planning Strategy that resulted from this study goes far beyond a simple listing of what we will need to supply power tomorrow. It sets out a whole range of responses to the societal needs and expectations of tomorrow's customers.

It also recognizes that business isn't what it used to be. Our customers are demanding far more in terms of service, information and assistance than they ever have before.

By necessity, the strategy must be dynamic and flexible, adapting to the changing needs and wants of Ontario's society. The strategy will be used to guide us as we make decisions about specific supply and demand options along the way.

The strategy calls for significant activity on the demand side of the electricity equation. We are trying to get our customers to use less power, and for a very good reason. With the supply options limited in the short term, Hydro has to do something about the gap between supply and demand that we see happening as early as 1994.

We are already dealing with it. Ontario Hydro has launched a demand management project -- it's a megaproject in its scale -- for the 1990s. It's a multifaceted approach to energy conservation, efficiency improvements and demand management that we hope will produce energy savings of 4,500 megawatts. If all the targets are accomplished, the savings will be the equivalent of a generating station 25 per cent larger than Darlington.

It breaks down to 1500 megawatts of information-driven efficiency improvements in the residential, commercial and industrial sectors; 2000 megawatts in incentive-driven efficiency improvements; and 1000 megawatts of load shifting, aided by time-of-use rates which went into effect this year.

We have also embarked on an ambitious non-utility generation program through which we hope to realize at least 1000 megawatts of privately developed parallel and cogeneration projects. An incentive system and favourable rate structure will go a long way toward encouraging such private developments and pushing production well beyond that 1000-megawatt plateau.

For example, an agreement has recently been reached with Inter City Gas for a 90-megawatt cogeneration project at their Boise Cascade plant, in Fort Frances. A 37.5 megawatt project is underway at Canadian Pacific Forest Products in Dryden.

We also expect to increase our generating capacity during the 1990s through a series of smaller hydroelectric generating projects, namely the Little Jackfish, Mattagami and Niagara Rivers, for a total of 1100 megawatts. And at the same time, we will be rehabilitating and upgrading existing plants in order to extend their lifetimes and, in some cases, to increase their generating capacity.

So where does all this leave us? Let me summarize it this way:

- If we meet all our conservation and load shifting targets, totalling 4,500 megawatts;

- If we can induce 1000 megawatts of non-utility generation;

- If we can build another 1100 megawatts of hydraulic capacity; and
- If we can maintain and extend the lifetime of our existing plant.

Then we should be able to meet the growing demand for electricity in Ontario to the turn of the century. But not beyond.

That is providing, of course, that the growth rate levels out to an average 2.7 per cent a year during the next decade. Since 1983, that rate has been more around the five per cent mark, meaning that the demand for power has been building at the rate of 1000 megawatts a year. That's enough power to drive a city the size of North York. Even at the 2.7 per cent rate, it will amount to 700 megawatts a year in the next decade.

What happens after the year 2000? The answer is, quite simply, we will have to have major new supplies of electricity to meet demand. As I speak to you today, there are only three alternatives available, purchases from neighbouring utilities, or fossil fuel and nuclear generation.

There may be other sources available tomorrow. Sources that are safer, cleaner, more economical and more dependable. But we simply can't wait.

It will take 10 or 11 years, for example, to build a cleaner burning coal-fired station, and a minimum of 12 years to build a new nuclear plant.

So that leaves us in the position of having to make those decisions about the next century's generating capacity now. And to get on with building them now.

While we are limited to those three basic choices, there are, of course, a variety of options to be looked at within each. This is particularly true with fossil-fuelled stations. Any new coal plant would be built to new, environmentally acceptable standards. And there are the possibilities of cleaner-burning oil or natural gas plants.

Cheap hydraulic power from Quebec is being touted as one option. But cheap is a relative term. Our cost of producing nuclear power wins hands down against the best offers from Quebec.

And would nuclear power necessarily mean another major Darlington project, or could we look to the success of the single CANDU unit in New Brunswick? Such an option would allow us to place generating stations more strategically within our system.

These are some pretty tough questions. And it is going to be up to Ontario Hydro, later this year, to start making some definite plans and recommendations. We will be guided in that decision-making by our Demand/Supply Planning Strategy. That is what the strategy is there for -- to help us in that critical planning stage, when we have to put something on the bottom line and say: This is it. From Hydro's perspective, these are the options and this is what we believe we have to do to maintain our electrical energy system in Ontario into the next century.

It will be based on the best information available. It will reflect our society's and our customers' values and concerns. And since no supply option can be environmentally benign, I can safely predict it will cause a good deal of interest and discussion when we unveil it in a few months.

While we don't have the final say on which technologies are chosen, it is within Hydro's mandate to present what we consider to be appropriate and responsible recommendations. But no matter which choices are made, the time for making them is upon us.

ELECTRICITY DEMAND MANAGEMENT

- Potential, Benefits, Barriers and Breakthroughs

Presented by:
Brian Kelly
Marbek Resource Consultants Ltd.
Ottawa, Ontario

ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

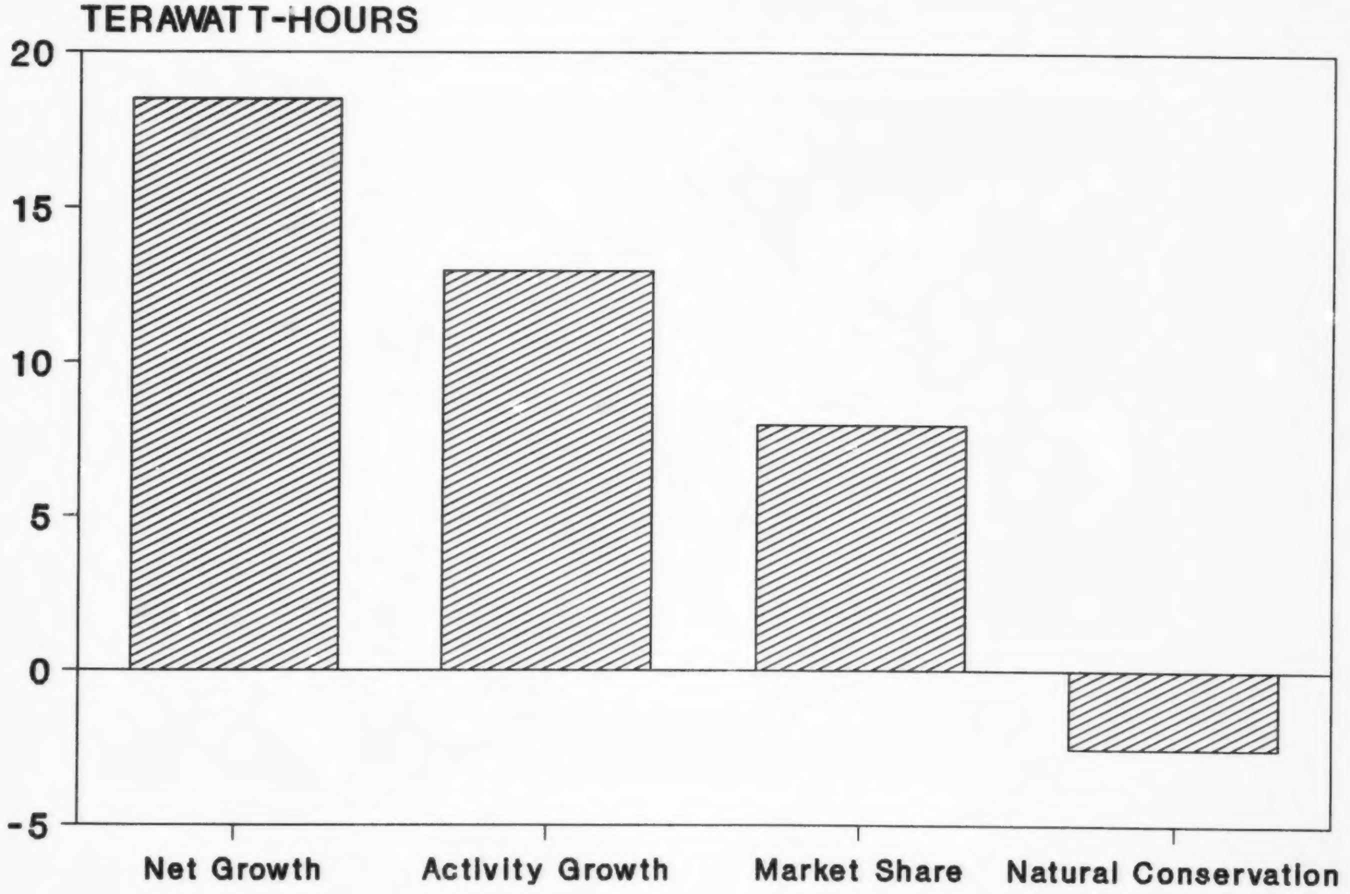
A. ESTIMATING DEMAND MANAGEMENT POTENTIAL

- ELECTRICITY CONSERVATION SUPPLY CURVES

- The electricity conservation supply curve is an analytical tool that allows the symmetrical comparison of the cost and impact of technologies for improving the efficiency of electricity utilization with the costs and impacts of technologies for generating electricity.

- Investments in electricity saving technologies (total societal costs) are amortized over the life of the technology and divided by the total amount of electricity saved to yield a cost of saved electricity in cents per kilowatt hour that is directly comparable to the cost per kilowatt hour of generating electricity.

COMMERCIAL SECTOR ELECTRICITY GROWTH
ONTARIO, 1985-2000, COMPONENT FACTORS



GURE 4.1

ELECTRICITY CONSERVATION SUPPLY CURVE FOR ONTARIO COMMERICAL SECTOR

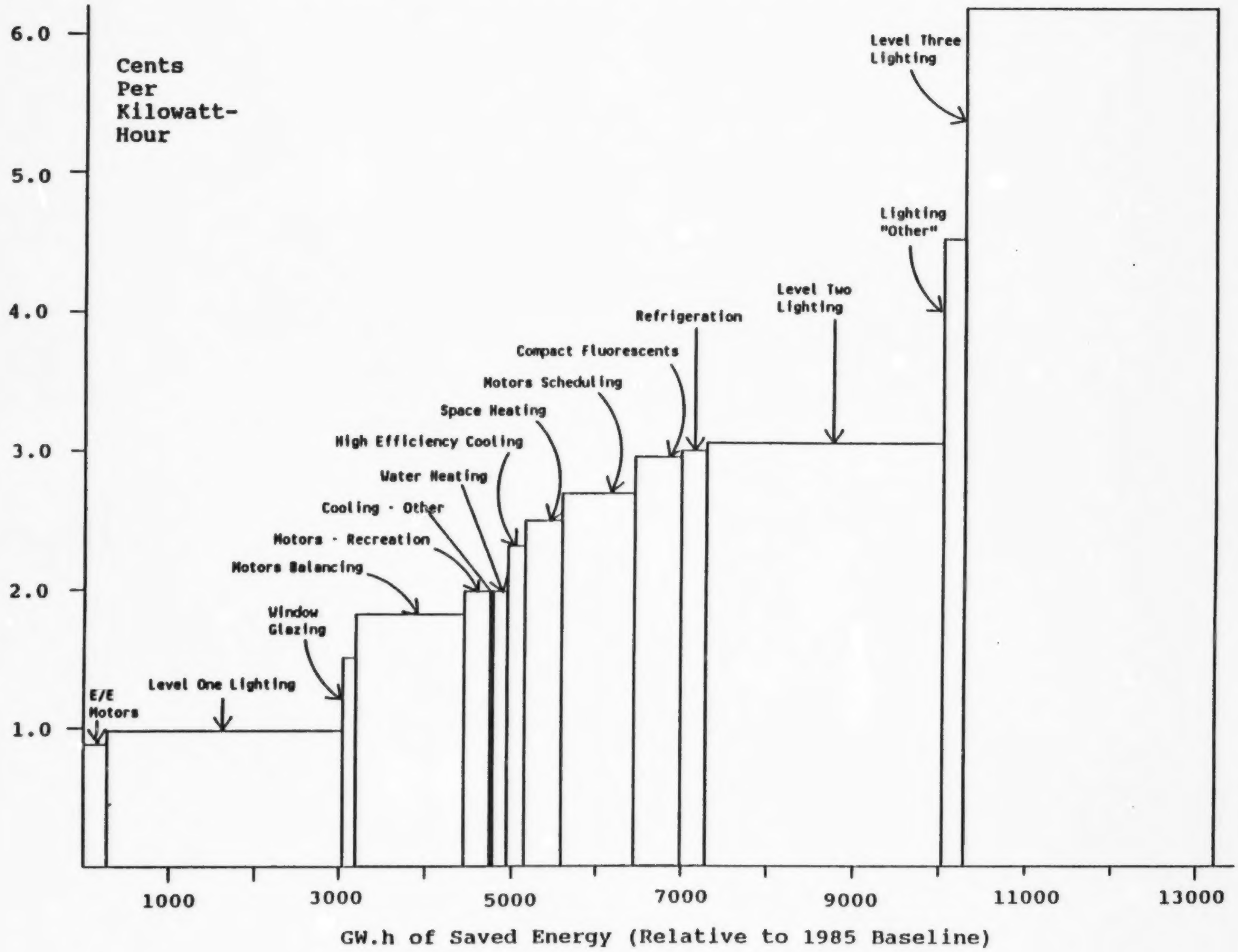


FIGURE 4.2

ELECTRICITY CONSERVATION SUPPLY CURVE FOR ONTARIO INDUSTRIAL SECTOR (1985)

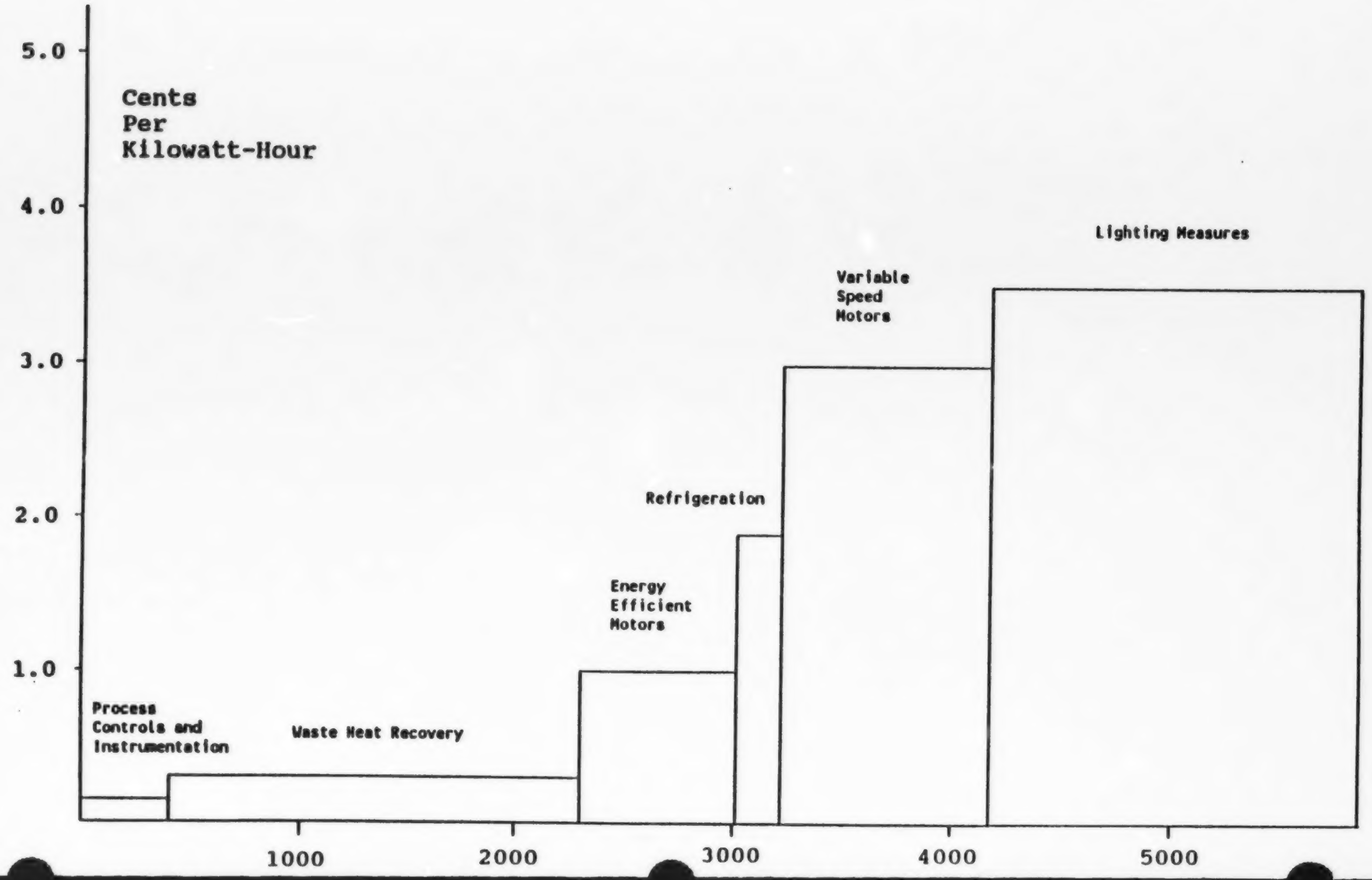


FIGURE 4.3

ELECTRICITY CONSERVATION SUPPLY CURVE FOR ONTARIO RESIDENTIAL SECTOR

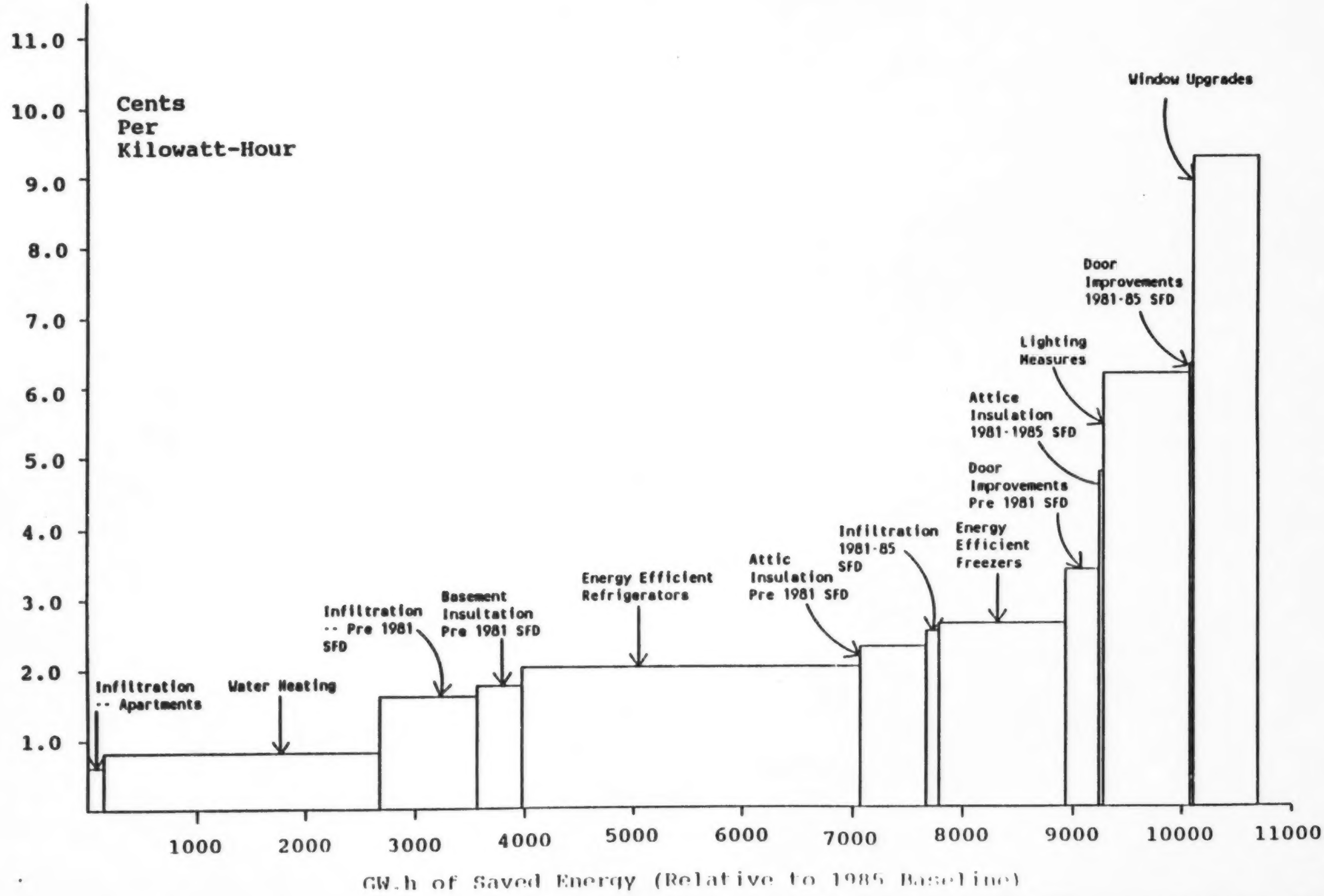
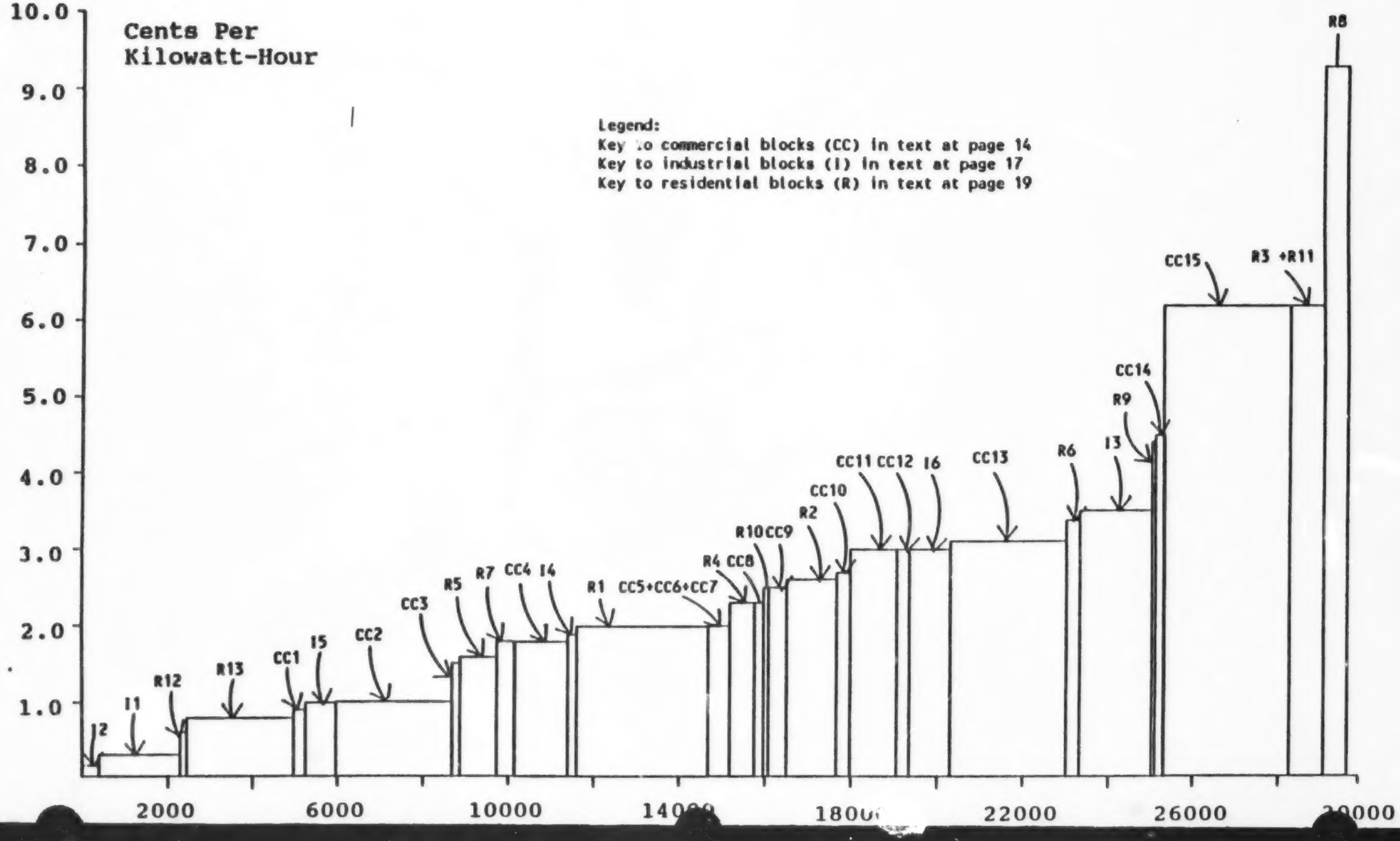


FIGURE 4.4

COMPOSITE ELECTRICITY CONSERVATION SUPPLY CURVE FOR ONTARIO



SUPPLY CURVES I

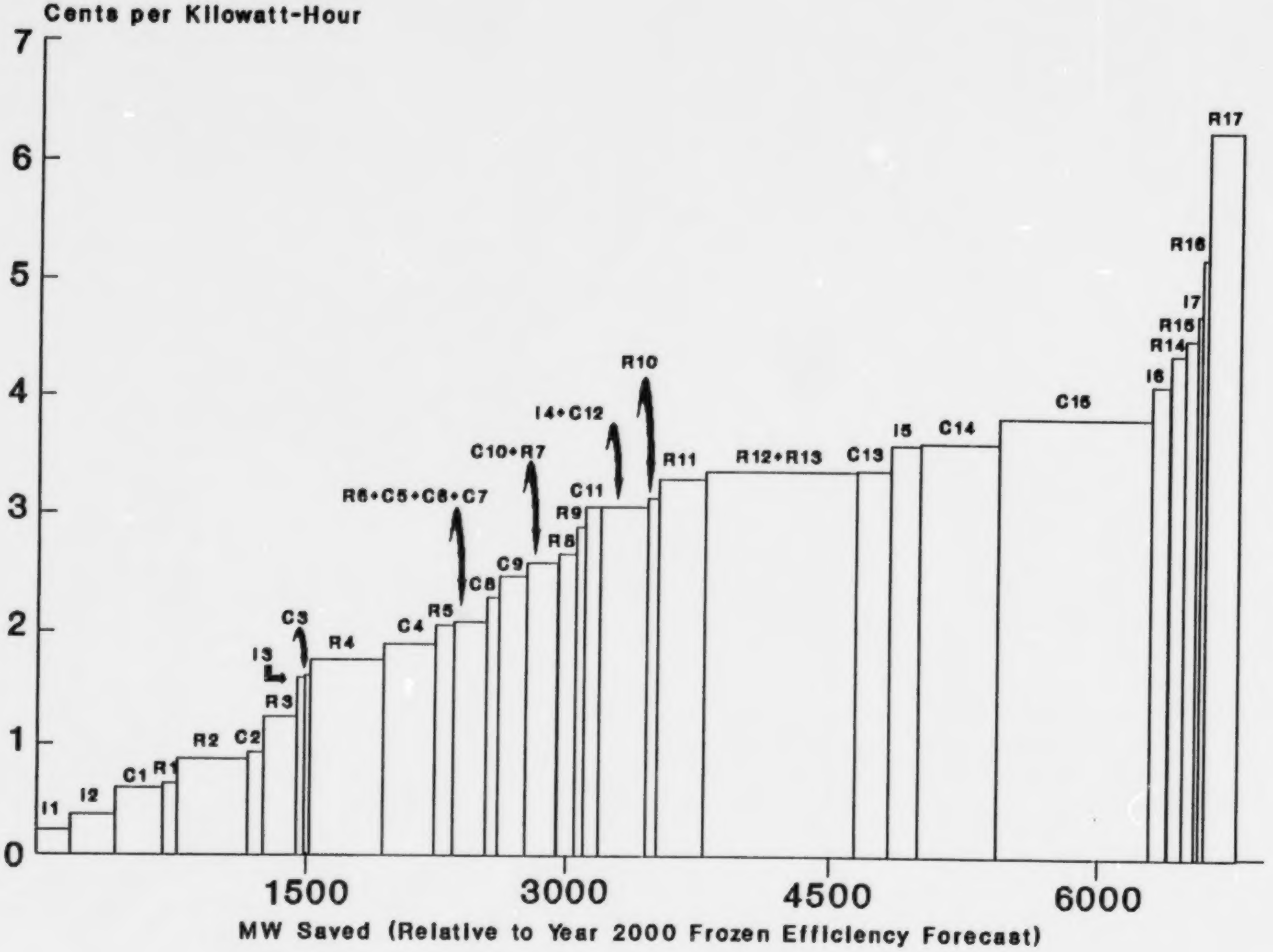
ELECTRICAL CONSERVATION POTENTIAL IN ONTARIO

1985 BASE

- 26,000 GWH per year at 5 cents/kWh or less
- 25% of Ontario Hydro's 1985 sales
- 10% more than total production of Darlington in a year
- Sectoral breakdown:
  - 42% Commercial
  - 23% Industrial
  - 35% Residential
- Failure of market to allocate resources efficiently

(Selected Technologies; Not Complete; Retrofit Only)

Composite Electricity Conservation Supply Curve for Ontario -- Power



SUPPLY CURVES II

ELECTRICITY CONSERVATION POTENTIAL IN ONTARIO

1989 TO 2000

- **At least 33,000 GWH/year of saving potential by the year 2000, all with measures under 5 cents per Kilowatt-hour**

- **This potential for energy conservation translates to a potential peak demand reduction of 7000 MW or 25% of projected peak power demand in 2000**

- **In terms of peak capacity requirements, this represents about 9000 MW or nearly three times the capacity of the Darlington nuclear station**

- **Sectoral Breakdown:**

    - **Commercial: 49%**
    - **Residential: 34%**
    - **Industrial: 17%**

(Partial potential only; selected existing technologies; more modest assumptions on replacement rates)

ONTARIO HYDRO

TARGETS FOR DEMAND MANAGEMENT

(All Figures in Megawatts)

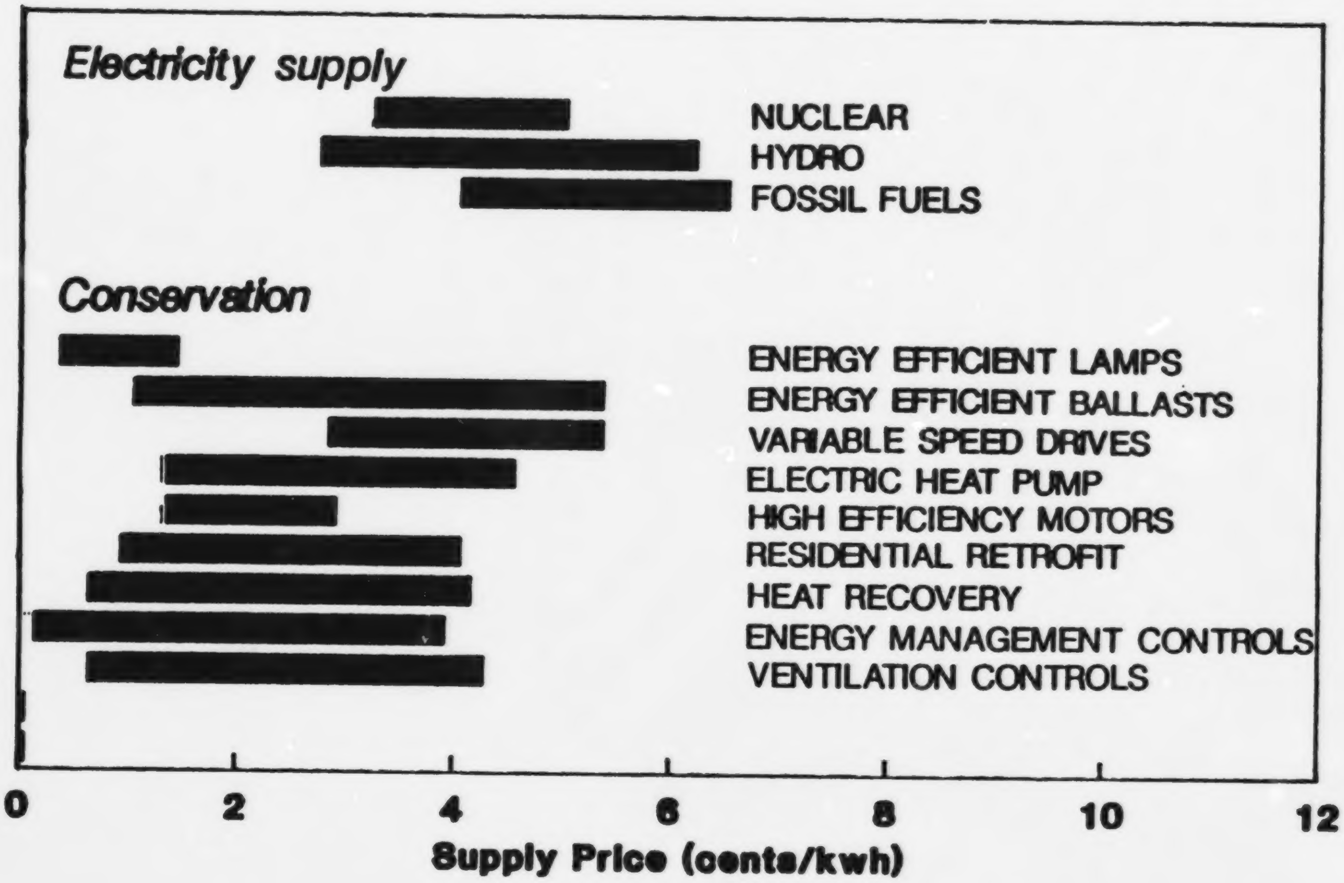
	1993	2000	
Electrical Efficiency Improvements (Incentive-driven)	183	2000	3,500 vs. 7,000
Electrical Efficiency Improvements (Information-driven)	393	1500	
Load Shifting	580	1000	
Total	1156	4500	
Interruptible Loads*	750	750	
Parallel Generation	650	1000	

* The level shown is approximate.

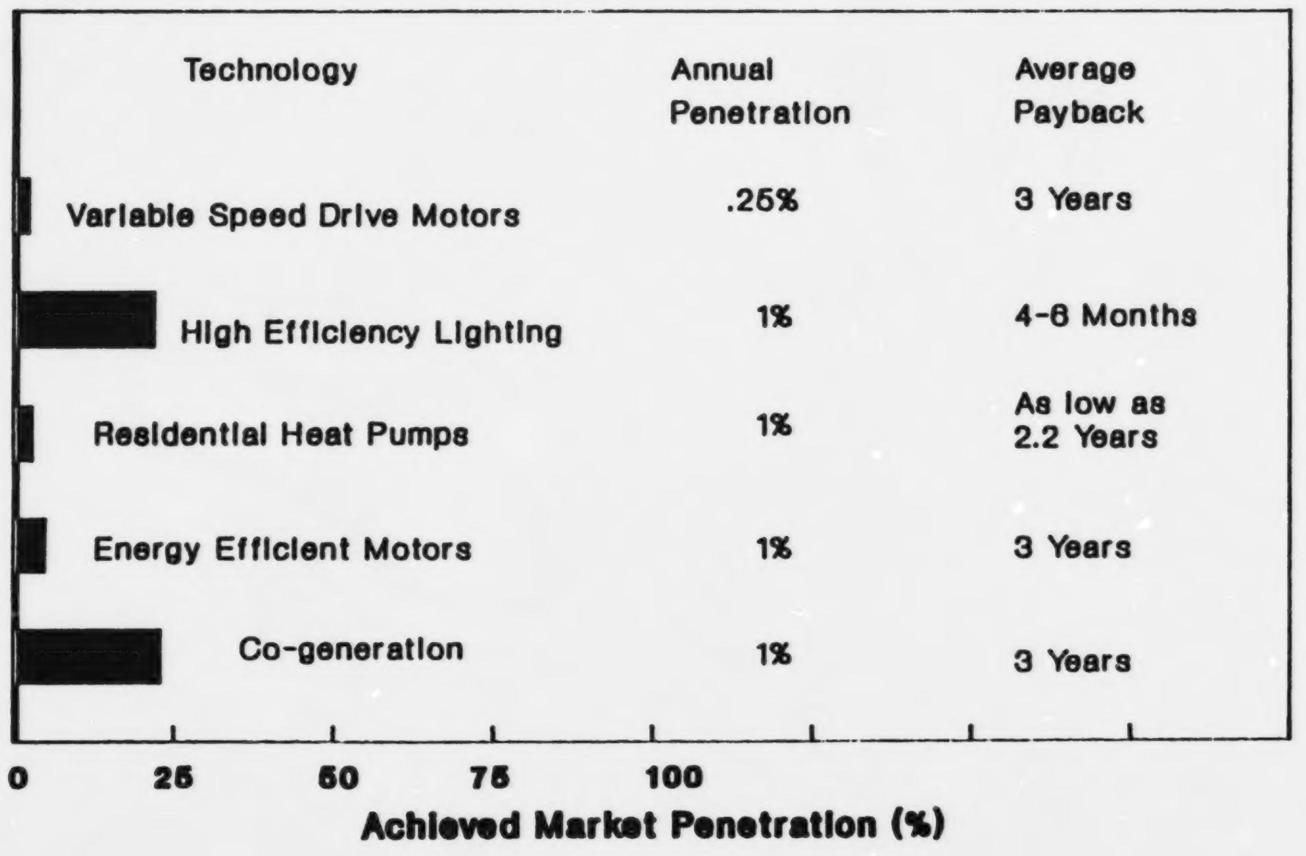
B. BENEFITS OF DEMAND MANAGEMENT

- major electricity savings / new plant deferral
- relatively short lead-time
- cost-effective compared with new supply *
- reduced consumer electricity bills
- improved competitiveness
- employment generating *
- environmental protection * (e.g. acid rain)
- climate protection * (e.g. $C0_2$ and greenhouse effect)
- reduced risk
- technological spinoff

ECONOMIC COMPARISON OF ELECTRICITY SUPPLY AND CONSERVATION OPPORTUNITIES

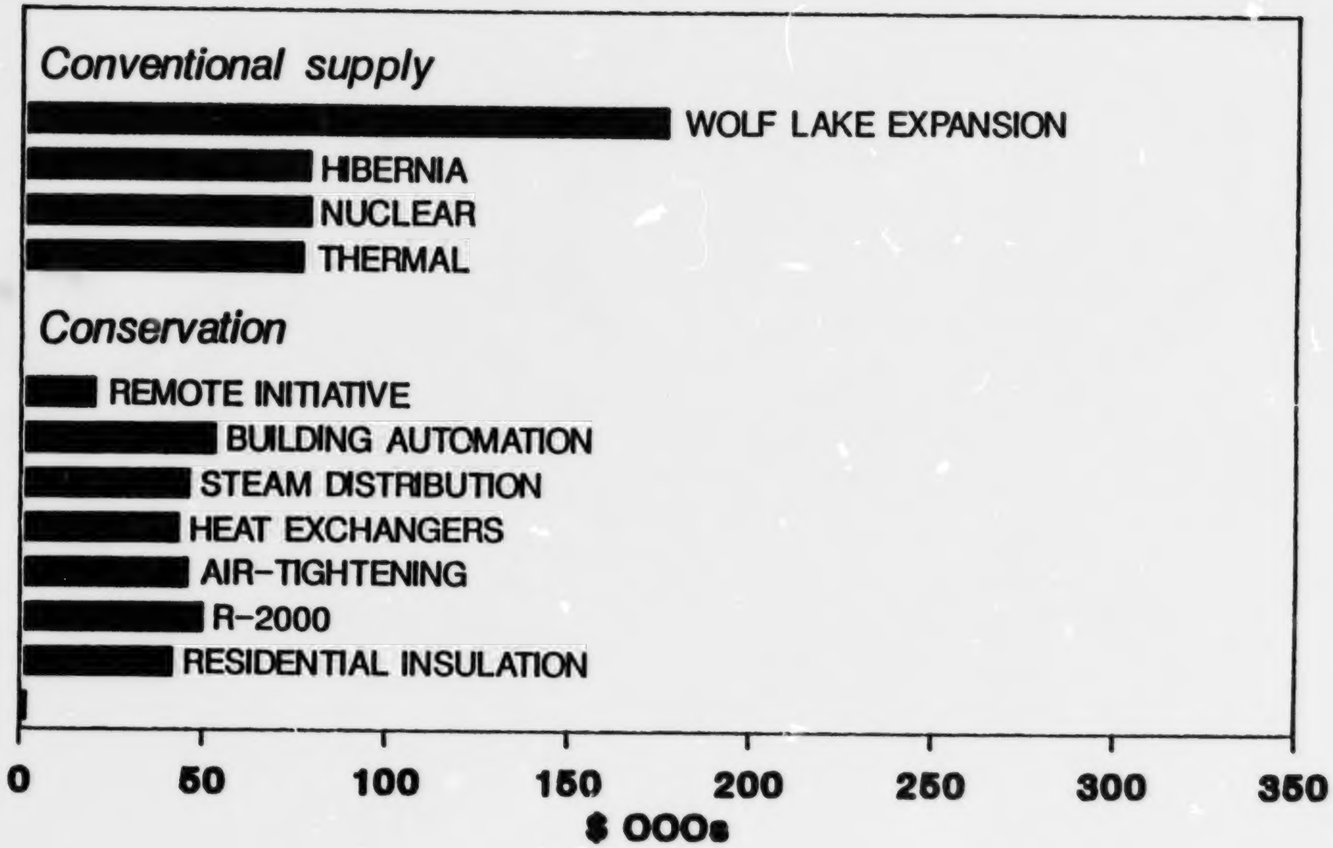


MARKET PENETRATION OF SOME ELECTRICITY SAVING TECHNOLOGIES



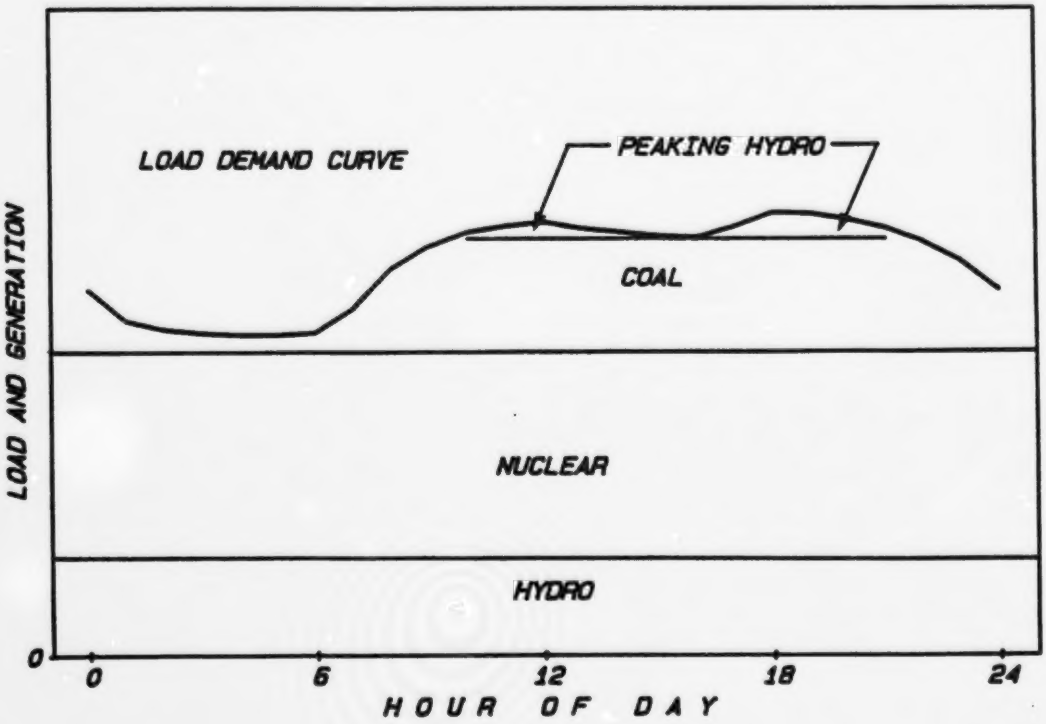
Technology	Annual Penetration	Average Payback
Variable Speed Drive Motors	.25%	3 Years
High Efficiency Lighting	1%	4-6 Months
Residential Heat Pumps	1%	As low as 2.2 Years
Energy Efficient Motors	1%	3 Years
Co-generation	1%	3 Years

INVESTMENT REQUIRED PER PERSON-YEAR OF EMPLOYMENT GENERATED



In Ontario, a kilowatt-hour saved is a kilowatt-hour of coal generated power

Figure 5.4
TYPICAL USES OF GENERATION RESOURCES



Compact Fluorescent Lamps

Billings Bridge Plaza - Ottawa
Old lamps: 150 W spots
New lamps: 9 W compact fluorescent with reflector

Per Lamp Savings

Electricity Savings:	140 W 1,226 kWh/yr
Dollar Savings:	$70/year (+ cooling savings & lamp replacement)
Environmental Savings:	

Coal	521 kg/yr
SO_2	16 kg/yr
NO_x	5.7 kg/yr
CO_2	1,814 kg/yr

Refrigerators
(17 cu. ft., Frost-Free)

GE:	121 kWh/month
Amana:	73 kWh/month

Savings over Lifetime (15 yrs.)

Electricity Savings:		8,640 kWh
Dollar Savings:		\$432.00 (at 5¢/kWh)
Environmental Savings:	Coal	3,636 kg
	SO_2	114 kg
	NO_x	41 kg
	CO_2	12,666 kg

Demand Management Measures:

- can replace the need for most flue gas scrubbers (SO_2 removal)
- pay for themselves through the value of saved energy
  - environmental protection is a bonus
- reduce all emissions (particulates, NO_x CO_2) not just SO_2
- the most effective strategy for reducing CO_2 emissions and the Greenhouse Effect

"..... legislated standards can lock society into a less-than ideal solution to a particular problem. One example is acid rain legislation that would mandate expensive flue gas desulfurization but not allow utilities to achieve the same sulfur dioxide reductions by investing in improved energy efficiency."

Building on Success: The Age of Energy Efficiency
Worldwatch Paper 82, Christopher Flavin and
Alan Durning, March 1988.

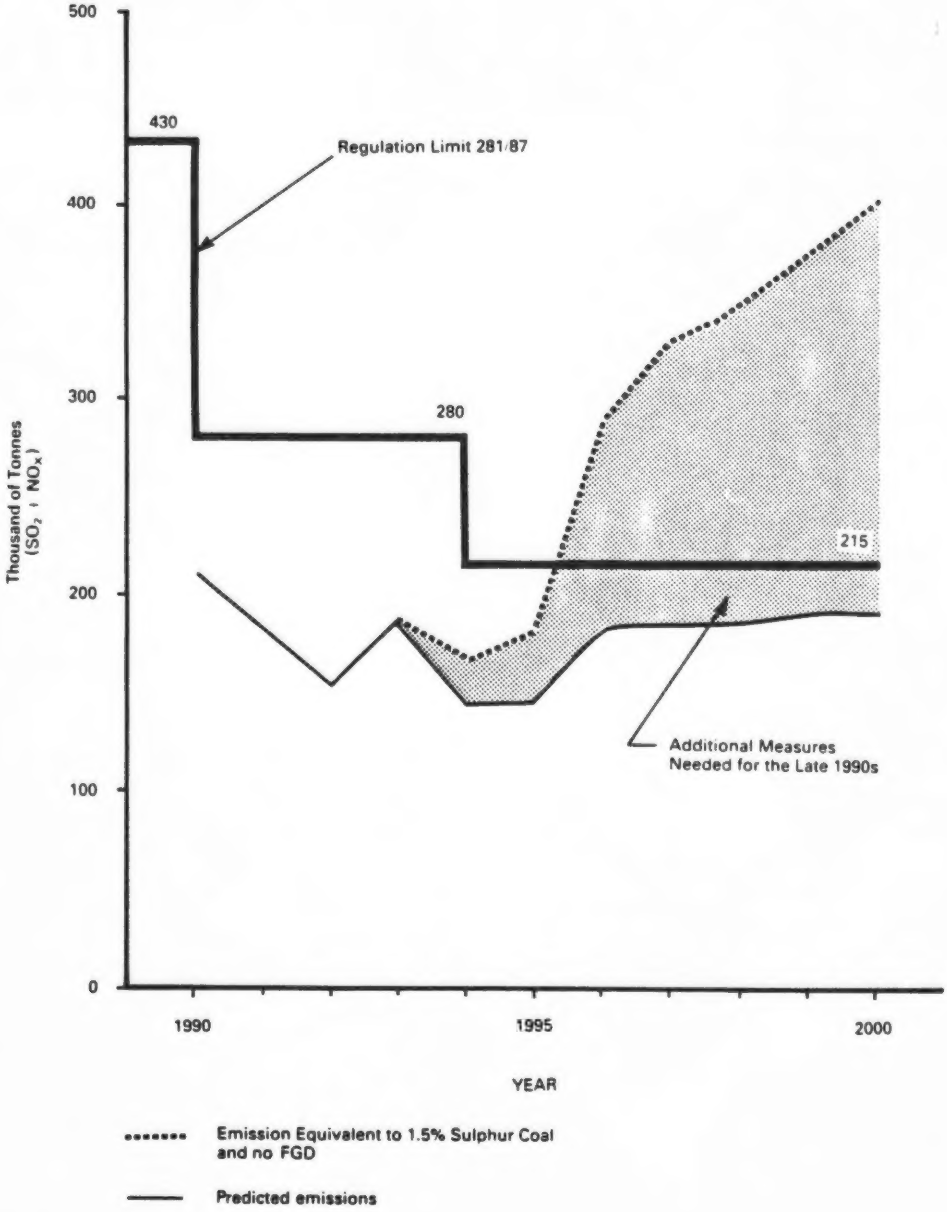


FIGURE 2-2
Future Acid Gas Emissions: 1990-2000

(Source: Ontario Hydro, 1987b)

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C. BARRIERS TO ENERGY MANAGEMENT

- MARKET BARRIERS
- INFRASTRUCTURE BARRIERS
- ONTARIO HYDRO / GOVERNMENT BARRIERS

MARKET BARRIERS

- Information / Awareness
- First Cost
- Confusion
- Technical Risk
- Split Incentives
- Warranties and Quality Assurance

INFRASTRUCTURE BARRIERS

- Codes and Standards
- Supply Infrastructure
- Installer Training
- Supplier Incentives
- An Electricity Management Industry

ONTARIO HYDRO / GOVERNMENT BARRIERS

- Power Corporation Act currently makes rebates illegal (amendments tabled in Legislature)
- Unreasonable tests for demand management
  - Revenues
  - Rates (no losers test)
  - Equity between customer classes
  - Benefits to Municipal Utilities
  - Hurdle rate (over 3 - year payback)
  - Failure to recognize total social benefits
  - Apparent upper limit of $300 / kW
- Reluctance to address market share issues
  - demarketing electric resistance heating
  - gas-fired cogeneration
- Entrenched supply orientation
- Poor long-term vision of Demand Management Programs
- Separation of Demand Management and Environment
- Lack of government policy direction on heating fuels and technologies
- Lack of effective regulatory function over Hydro

D. BREAKTHROUGHS

- accelerated evolution of Demand Management Programs
- Demand Management and Environment Superfund

ELECTRICAL DEMAND MANAGEMENT SHOULD INCLUDE:

- electrical efficiency
    - design
    - equipment
    - operation
- peak shifting
    - design
    - equipment
    - operation
- de-marketing of electric resistance space and water heating*
- cogeneration*

* Ontario Hydro is reluctant to address these issues

Demand Management Budget

1989 to 1993: $900 million

"By 2000, the accumulated cost for Energy Management initiatives could be $2 to 3 billion"

Demand Management Programs

PROGRAM	Time Frame	Nature	Coverage	Mechanisms	Cost Limitation	Assurance of Savings
1st Generation	'89-'92	technology driven	EE technologies some peak shift	information loans - rebates audits	$300/kw?	low - medium
1st Generation Extended	'90-'92	technology driven infrastructure development	add: heat demarketing new buildings cogeneration	add: codes & standards heat policy	$500/kw?	medium
2nd Generation	'92-'95	market driven infrastructure dev. comprehensive	add: new technologies control systems	add: purchase of energy saving ESCOs	full avoided cost	high
3rd Generation	'94-2000	market driven	add: new technologies	bidding	full avoided cost	high

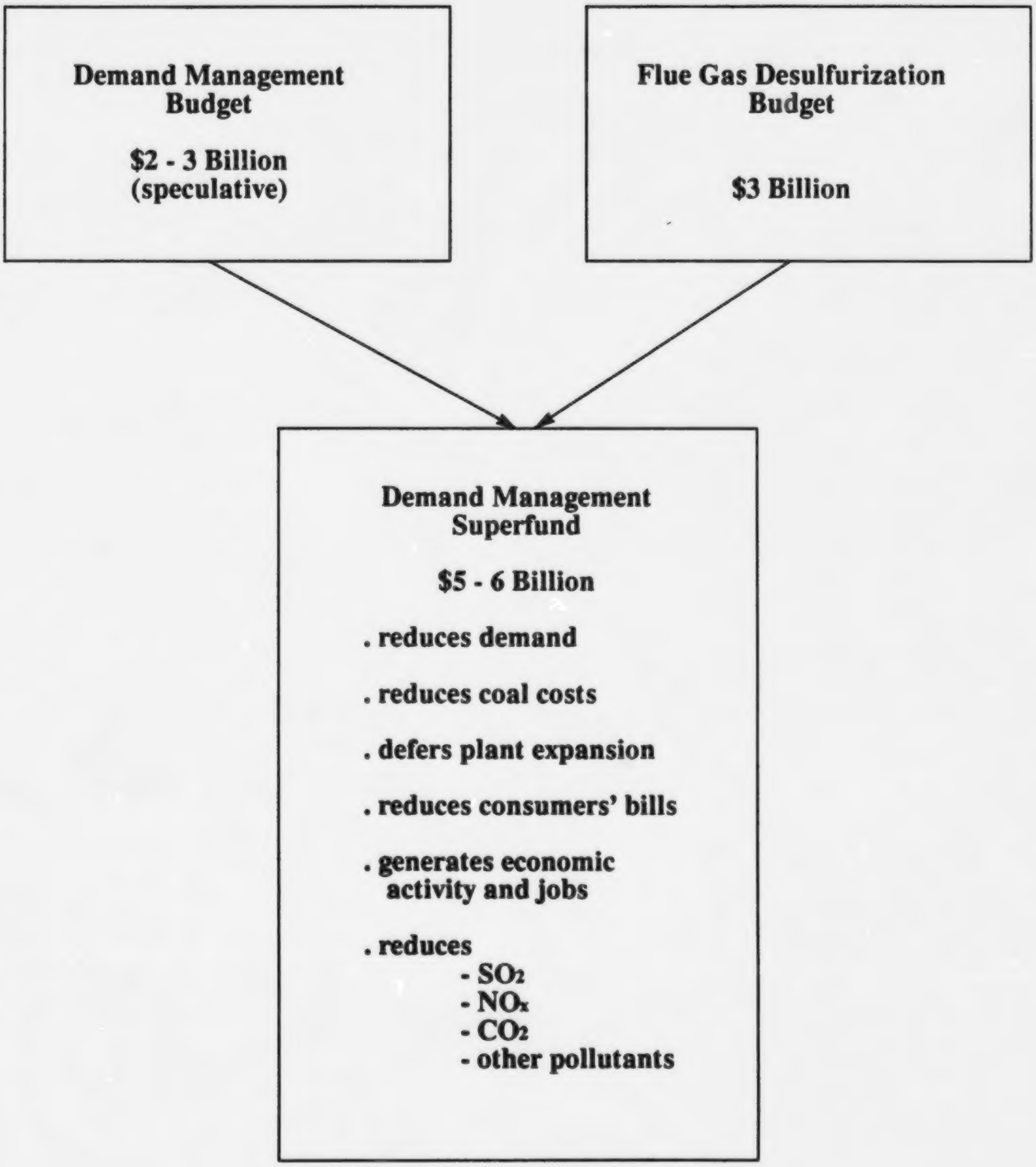
Flue Gas Desulfurization Budget

TABLE 2-2

Illustrative FGD Programs Funds and Rate Level Impacts

ASSUMPTIONS			
Load Growth (per annum)	1.0%	2.4%	4.0%
Demand Management*	-	2000 MW	1750 MW
Non-Utility Generation*	-	330 MW	550 MW
Electricity Purchases*	-	-	1000 MW
FGD (500 MW)*	2	8	20
OUTFLOW OF FUNDS TO THE YEAR 2000			
TOTAL $ BILLION	**$0.5**	**$2.9**	**$5.5**
Capital Expenditures	51%	55%	59%
Interest on Debt	18%	20%	17%
Debt Repayment	19%	12%	12%
OM&A	12%	13%	12%
	100%	100%	100%
RATE IMPACT IN THE YEAR 2000	**+1%**	**+3%**	**+4%**

*** By the year 2000**



Demand Management Budget

$2 - 3 Billion (speculative)

Flue Gas Desulfurization Budget

$3 Billion

Demand Management Superfund

$5 - 6 Billion

- **reduces demand**
- **reduces coal costs**
- **defers plant expansion**
- **reduces consumers' bills**
- **generates economic activity and jobs**
- **reduces**
  - **SO_2**
  - **NO_x**
  - **CO_2**
  - **other pollutants**

E. SUMMARY

- Technical and economic potential for Demand Management is very large; equal to 3 Darlington plants by the year 2000

- Multiple Benefits

  - major savings / plant deferral
  - short lead time
  - economic
  - employment
  - environmental
  - reduced risk

- Barriers to be Resolved

  - market
  - infrastructure
  - Hydro / Government

- Breakthroughs

  - accelerated and comprehensive Demand Management Programs
  - Superfund for Demand Management and Environment

THE NUCLEAR OPTION

Presented by

D.S. Lawson
President, CANDU Operations
Atomic Energy of Canada Limited
Mississauga, Ontario

ONTARIO'S ENERGY CHOICES CONFERENCE
Toronto, April 3-4, 1989

The issue before us this afternoon is the choice of electricity options. I will address the nuclear option and I aim to show that it is a viable option.

My credentials for making this case are that I run the division of AECL called CANDU Operations which is responsible for designing, marketing and implementing CANDU. We operate on a commercial basis, without government subsidy, and have implemented successful projects in Canada and in the export market. Despite lack of orders in the industry and cutting our staff to one third, we are ready now with improved CANDU products for the next decade.

The benefits from continuing the CANDU option are just that - the benefits continue.

As key decision makers and influential members of society I ask that you consider the fundamental requirements for Ontario's energy choices and assess the total impact of nuclear power in meeting these requirements.

Today I will cover:

- where we have come from; the story to date
- the case for nuclear and CANDU
- the requirements; can they be met?
- the key issues

and - what actions are necessary to have a strong nuclear option available for electricity generation?

The Story To Date

The promise made at the start of the Canadian nuclear power program is best summarized by AECL President Lorne Gray's submission to a Federal Parliamentary Committee in 1960.

> "Canada has large untapped hydro-electric resources and an abundance of low-cost fuels....There is, however, the problem of uneven distribution. The location of Canada's major conventional energy resources (coal, oil, gas) is, in the main, distant from the regions of highest energy demands. Once a fuel-poor region has exhausted its hydro potential, it is faced with the prospect of fossil fuels. The prospects of atomic energy from Canadian uranium may well alleviate such a situation and offer an alternative. Uranium exists in abundance in central Canada, and transportation costs for such a concentrated fuel are negligible. In any case, development of atomic power should introduce a new ceiling on power costs and, under some circumstances, will reverse the trend of the ever-increasing cost of electric power."

The rationale for CANDU from the beginning of the Canadian program was to provide each Canadian province with a new energy supply option for the time when economic hydro-electric resources had all been committed to service. The primary objectives were (a) to keep electric power costs low, (b) to develop an engineering industry to build nuclear reactors, and (c) to develop markets for uranium.

The record to date is one of a promise fulfilled.

During 1988 CANDU nuclear electricity provided 48.5% of the electricity in Ontario, 4% in Quebec, and 28% in New Brunswick. To put this in perspective, the nuclear generated electricity in 1988 was 79% of the total electricity consumed in Canada in 1960 when Lorne Gray made his statement. Canada ranks fifth in the world for nuclear energy generation **(Figure 1)**.

Twenty CANDU units are in operation and nine more are under construction. Canada is fifth out of nine international nuclear vendors, ranked by units sold.

Have we met the three objectives quoted by Lorne Gray? Have we kept electric power costs low? There has been debate and review of nuclear power costs. However, when you look at the broad picture, Ontario with half its electricity generated by CANDU has comparable overall electricity costs with those provinces with cheap hydro-electric resources such as Quebec and Manitoba **(Figure 2)**.

We have developed an engineering industry to build nuclear reactors. The original concept was to build upon and further develop the strength of existing Canadian industry. This has been successful despite the large fluctuation in the nuclear orders. More than $15B in manufacturing orders and service contracts has been generated for more than 150 Canadian companies. The high quality standards that had to be adopted have opened doors to new sophisticated markets in Canada and elsewhere.

The markets for Canadian uranium have developed well with Canada now supplying one third of total western world production, and thus being the world's leading producer and exporter of uranium.

The Case for Nuclear and CANDU

Worldwide, nuclear can continue the benefits realized to date and promise greater benefits to a world that needs both power and a better environment.

In terms of safety, nuclear-generated electricity has a long, successful track record in Canada and other regions of the world. Nevertheless, incidents such as Chernobyl and Three Mile Island have tarnished the industry's reputation for safety. The industry must therefore continue to address public concerns and to maintain the highest safety standards. It also must draw comparisons with other methods of energy generation that support the contention of technical experts that nuclear is safe.

Nuclear energy also fits the Brundtland definition of an environmentally sound energy source. Unlike fossil fuels, nuclear energy does not generate emissions that contribute to acid rain, the greenhouse effect, or the depletion of the ozone layer. Nor do nuclear energy plants devastate large tracts of land, as is often the case with hydro impoundments. Instead, nuclear energy produces a relatively small quantity of wastes that the industry has already demonstrated can be safely managed and stored.

Finally, nuclear energy is a sound choice based on economics. Nuclear power is less expensive than oil virtually everywhere, and moderately less so compared with natural gas. It is cheaper than coal except in regions close to mines, and it is less expensive than hydro power except in regions close to hydro dams. Furthermore, on an energy per weight basis, 17,000 times more electricity can be generated from CANDU uranium fuel than can be generated from coal.

Nuclear power also shares with hydro the additional advantage of being essentially a constant-cost power source. Although both nuclear and hydro power demand a high initial investment for situating plants, they offer utilities a lifetime of relatively low, inflation-resistant operating expenses.

The case for nuclear is being stated more strongly in recent months by key world leaders and concerned members of the public. A few of these statements have been collected in Appendix A.

With a case for nuclear established, is there a position for CANDU? Germany abandoned its own technology to buy American. France gave up its own gas cooled reactors for a license from the U.S.A. and recently the U.K. has followed suit. We have asked ourselves whether we should do the same. The answer is that it would be more expensive to make the transition and we would lose some of the benefits we now experience. The cost of transfer based on the European experience would be many billions. The existing CANDU units have to be supported throughout their life as well as supporting the new technology. We would be dependent on imported enriched uranium and the Canadian content would decrease. The estimated cost of electricity would be higher. CANDU was originally designed for the utility market, whereas the Pressurized Water Reactor (PWR) was conceived for submarines. CANDU has competed successfully in international markets and the predicted improvements for future CANDUs at least match, if not surpass, the quoted improvements by the competition.

We conclude we should stick to CANDU.

What are the requirements that the nuclear option has to meet?

The requirements that have to be met are socially acceptable targets under five headings:

- environment
- safety
- cost
- economic benefits
- security of supply **(Figure 3)**

It is not easy to define what is the socially acceptable target for the environment. One could say it is to halt and preferably reverse adverse impacts on the environment. Nuclear generated electricity does not add to the acid rain problem or the 'greenhouse effect'. On the other hand accidents like Chernobyl are unacceptable to the public. Many lessons have been learnt from Chernobyl, amongst them the need to contain damage to the site by the provision of a strong containment vessel around the whole nuclear plant. Nuclear plants add maybe 1% to the radiation levels of people living around the site. This is about the same level of radiation as you receive on a flight to the West Coast. Natural background radiation is decaying with the age of the earth. When man's earliest ancestors roamed the earth the natural background radiation was 12 times what it is today. We are proof that man survived, so we should be quite safe living next to Pickering.

Safety is important to those of us in the industry as well as the public. How safe is safe enough? is a question unlikely to be answered for some time. Nothing is without risk, and defining the level of risk acceptable to society is not easy. At the start of the Canadian nuclear program the target was for the safety to be as good as the best of industry. This has clearly been achieved by a large margin **(Figure 4)**. Ontario Hydro's nuclear workers are safer at work than anywhere else. The public health has not been adversely affected **(Figure 5)**. In fact the spinoff benefits from Cobalt 60 use in medicine has had a health benefit for the public.

The nuclear industry is still embarrassed to be reminded of the statement of "nuclear energy being too cheap to meter". However the record worldwide, with the exception of a few badly managed units, is that nuclear has in fact been cost effective. Nuclear power had to remain competitive with alternative sources of energy. Our studies continue to show that CANDU can be competitive with other fuels for electricity generation in most circumstances. Recently we had an independent review of our costs showing that our new CANDU 3 can compete economically with the same size coal unit built in New Brunswick using cheap imported coal. This review, conducted by Toronto and New York bankers, agreed with us that CANDU is economic. CANDU, like all nuclear units, is capital intensive. Hence the more KWh you get from the unit each year, the cheaper is each unit. The measure of this is called the capacity factor - how much energy is delivered as a fraction of the maximum licensed output times the period of time considered. The figures for last year and lifetime for all 20 CANDU units operating is shown in **Figure 6**. On a lifetime basis all but two are in the top half of the performance table. The two in the bottom half are Pickering 1 and 2 when their extensive outages to retube have been included. However, following retubing, they are like new reactors and have a long life ahead of them.

In addition to the direct cost of nuclear generated electricity, one has to see the total economic benefits. The benefits of nuclear power appear in many areas and cannot readily be seen in one set of accounts. The electricity users of Ontario have to date avoided paying about $8 billion in balance-of-payment terms by using CANDU in place of imported coal. Canadian industry has had work and profits from its nuclear contracts, both from domestic and export projects. The Ontario Premier's Council in its reports 'Competing in the New Global Economy' sees the nuclear industry as belonging to the category 'High Growth and Emerging Industries'. Growth of the Canadian nuclear industry will provide many benefits to Ontario.

Society's view on security of supply is not easy to quantify. However reliable electricity supply is a requirement - as long as it is at an acceptable cost in terms of dollars, safety and effect on the environment. Nuclear power, using domestic uranium and built by local companies and labour, can probably meet society's requirements for security of supply.

What Are The Key Issues?

Over and above the meeting of the requirements there are some key issues. These are:

- nuclear waste
- the future of the industry
- and support.

The handling and storage of nuclear waste is often quoted to be the main problem for nuclear power. The facts do not support this concern. There are today sound engineering solutions for short term and long term storage of low and high level nuclear wastes. These solutions meet environmental and safety standards and the costs for future storage are collected as part of the cost of each unit of nuclear electricity generated and sold. Appendix B is a copy of a recent OECD/NEA/AECL brochure on the subject.

A successful future for the Canadian nuclear industry is dependent on many factors. Is the demand for electricity such that utilities are buying? Is the utilities' view of nuclear sufficient to order new reactors? Are there sufficient dollars and human resources to meet the needs? Is the supply industry ready to deliver and are the supporting infrastructures of research and regulation available?

The nuclear option here in Canada, as in many countries, is characterized by:

- government funding of research
- government involvement in risk taking - both in financing projects and insurance
- government regulations for environmental assessment approval, safety licensing and export permits
- and the return to government being long term and indirect through use of indigenous resources, economic growth through low electricity prices, and improved environment.

These factors have led to nuclear projects not being commercial when the test of what is commercial is whether private sector business and financial institutions will take the majority of the risks for the financial benefits. The apparent high cost low probability risks, government regulatory control, and government control of electricity pricing deters private business initiative. This does not mean that nuclear is not economic. The assessment of past nuclear projects shows them to be economic and predictions for the future show that nuclear can compete with other options on economic grounds even without trying to quantify the additional economic benefits of less environmental damage and indigenous control.

Examination of past nuclear experience worldwide shows that the successful programs have clear, consistent and persistent central government commitment and direction. They have also to be supported by r&d during both construction and operation. Those characterized by frequent reviews and changes of direction have been far less successful.

A successful nuclear program requires the commitment, support and alignment of all the key players. The political support should start with the top political leaders and could well be modelled on some of the statements listed in Appendix A.

What Actions Are Necessary To Have A Strong Nuclear Option Available?

First there needs to be a clear decision and statement that Canada wants to be in the nuclear business. Preferably this should come from both the federal and provincial leaders. The federal and provincial governments either directly or through their agencies have control of R&D, design, promotion, regulation for safety (AECB), environmental review, building and operation of nuclear units, insurance, financing, rate setting and export control. The private sector industry has a role which, at present, is mainly one of supplying equipment and services to the agencies of the two levels of government.

Second, despite the good performance of CANDU to date, we need to reduce capital costs, improve total quality, shorten delivery, provide less shocks and risks to customers. We have assessed that there are good, realistic ways of achieving these improvements and that this can best be accomplished through strengthening the industry with a rationalization of key resources and closer teamwork between all sectors.

Summary

The Canadian nuclear industry has lived up to its original promise and provided substantial benefits to Canada.

The nuclear option can adequately meet the requirements that society places on it.

The key issues can be managed and the nuclear option can provide ongoing benefits to Ontario. The scale of future benefits both directly in efficient electricity production and in trade will depend on getting wholehearted political support and a rationalized industry. With this support a new CANDU industry could obtain a much larger share of the world nuclear market and at the same time provide benefits to the environment.

Appendix A - Quotes

"It may seem strange that I, as a conservationist and environmentalist, am a proponent of nuclear power plants. However, I have used my technical background to compare what I perceive to be the risks inherent in nuclear power with the health, safety, environmental and strategic implications of other forms of energy, including oil, coal, tar sands, etc. I have concluded that I and my family would be at lesser risk living next to a CANDU power plant and having a cottage adjacent to an AECL nuclear waste disposal site than we are in having a potentially dangerous gas-fired furnace and electrical wiring in our home, and a tank of flammable and potentially explosive fuel in our cars."

David Waldman, President, The Conserver Group, Inc., Advisory Committee Member, Energy Options Process, Energy and Canadians Into the 21st Century, Report on the Energy Options Process, 1988.

"A realistic attitude toward nuclear power -- one source that does not add to the greenhouse effect -- is essential."

Richard Wilson, Mallinckrodt Professor of Physics, Harvard University, Cambridge, Massachusetts.

"The committee wishes to make its position clear from the beginning: maintaining the nuclear power option is vital to Canada's interest, as it is vital to the interests of society in general. There is a compelling case to be made in support of continued nuclear development, a case based upon the future inadequacy of conventional petroleum resources and upon the environmental degradation arising from burning coal in progressively greater quantities for electricity generation."

Nuclear Energy: Unmasking the Mystery, Report of the Standing Committee of Parliament on Energy, Mines and Resources, 1988.

"In the view of the advisory committee, the nuclear option should be sustained as a component of Canada's energy mix."

Energy and Canadians into the 21st Century, Report on the Energy Options Process, 1988.

"We will work to cut down the use of fossil fuels, a cause of both acid rain and the greenhouse effect....That means a policy for safe, sensible and balanced use of nuclear power."

Margaret Thatcher, speech to Conservative Party Conference, Brighton, U.K., 1988 October 14.

"There's absolutely no doubt that if we want to arrest the greenhouse effect we should concentrate - like the French are - on a massive increase in nuclear generating capacity.
Nuclear power stations give out no sulphur and no carbon dioxide. So that they are, as it were, the cleanest form of power generation...."

Nicholas Ridley, U.K. Minister of Environment, BBC Current Affairs Program "On the Record", 1988 October 30.

"The government remains fully committed to a key role for nuclear power. I make no apologies for that. Nuclear energy remains the only feasible alternative to fossil fuels, certainly until the end of the century....Anyone ready to gamble on abandoning nuclear power would leave us to facing a very uncertain future.
I see nuclear energy as representing an opportunity rather than a problem....Renewable sources are unlikely to achieve maturity for another 50 years. So I believe that there is an overwhelming case for maintaining the nuclear option, both strategically and environmentally..."

Cecil Parkinson, U.K. Minister of Energy, Electricity Conference Speech, London, 1988 November 7.

"Had nuclear energy's 16% share of the world's electricity in 1987 come from coal-fired units, the result would have been the release of 1,600 million tons of CO_2, 2 million tons of SO_2, 1 million tons of NO_x, and about 150,000 tons of heavy metals including arsenic, lead, vanadium, mercury, nickel and chromium."

Hans Blix, Director General, IAEA, United Nations at USCEA Conference, 1988.

"By every measure the death rate from coal power is much larger than the death rate from nuclear power. Per unit of energy extracted, coal mining claims more than ten times as many deaths as uranium mining. Far worse are the civilian casualties. Study after study into the deaths caused by coal pollution agree that the figure is about 50 deaths per medium-sized coal station per year. The figure is necessarily tentative because coal pollution is diffuse and insidious in its effects. It translates into 25,000 deaths per year in the United States and 1,700 deaths per year in the United Kingdom. The World Health Organization estimates that the Chernobyl accident may cause 1,600 premature deaths over the next 30 years. Thus coal power in the United Kingdom kills more civilians in one year than Chernobyl will kill in 30. And Chernobyl is the only civilian nuclear accident ever to claim a life. Three Mile Island killed nobody, injured nobody and exposed the nearest civilians to radiation less than one tenth of one dental x-ray."

Andrew Kenny, The Spectator, 1989 February 11.

Brice Lalondé, former head of Friends of the Earth in France, and later France's Secretary of State for the Environment, now agrees that French nuclear plants are sufficiently safe and has said that he had realized 'with the support of scientific proof, that nuclear safety was much more assured' then he had formerly believed.

Figaro, 1988 October 22.

The American Medical Association has approved "Medical Perspective on Nuclear Power", a report prepared by the AMA's Council on Scientific Affairs. The report includes the following conclusions and recommendations:

- Adequate capacity to generate electricity is necessary for people's health and well-being and for the progress of society.
- Creating electricity with nuclear power is a safe method in the U.S., both absolutely and in comparison with alternative methods.
- Physicians have a societal obligation to contribute to efforts to improve public understanding of the benefits and risks of nuclear power compared with alternate ways to generate electricity.

"With coal and nuclear the two main sources for future electricity supply and with the former constrained by the greenhouse effect, nuclear is likely to emerge as a winner in the decades ahead. The next century will be a nuclear one and an electrical one."

William Brown, former Director of Energy Studies, Hudson Institute, 1988 December 12.

Providing clean, economical power

- the 111 licensed U.S. Nuclear generating units now provide nearly 20% of the nation's electric power. Their total generating capacity is over 99 million kilowatts -- enough to meet the residential electric power needs of more than 80 million people.
- Nuclear power is the second largest source of electricity in the United States. It overtook oil in 1980, natural gas in 1983 and hydropower in 1984. Only coal provides more of the nation's electricity. Coal and uranium will continue to be the major sources of U.S. electricity for the foreseeable future.
- Generating electricity with nuclear power reduced total CO_2 emissions in the United States by 9% in 1987. Worldwide, nuclear plants reduced CO_2 emissions by 7%. Such emissions have been linked to "the greenhouse effect" and potential global warming.

- Had the nuclear energy option not been available to utilities, consumers would have paid $60 billion more for their electricity between 1973 and 1987, due to higher fuel and operating costs of alternative fuels.
- In 1988 electricity generated by nuclear energy increased by 15% over 1987, to 524 billion kilowatt-hours -- more electricity than has ever been produced by any source other than coal in a single year. An equivalent amount of electricity generated by fossil-fired plants would require burning approximately 225 million short tons of coal, 775 million barrels of oil, or 5 trillion cubic feet of natural gas.

USCEA, Washington, 1989 February.

Reducing Foreign Oil Dependency

- Nuclear energy has played a critical role in holding down oil imports and the trade deficit. In 1988, nuclear energy saved the U.S. 876,000 barrels of oil per day, reducing the trade deficit by nearly $5 billion.
- Since 1973 nuclear energy in the U.S. had displaced 3.9 billion barrels of oil, resulting in a cumulative reduction in the trade deficit of $114 billion (in 1988 dollars).
- Through the increased use of coal and nuclear energy, the U.S. has been able to cut back on its use of oil to generate electricity by 55 percent since 1973, even though total electricity use has grown by 50 percent.

USCEA, Washington, 1989 February.

APPENDIX B

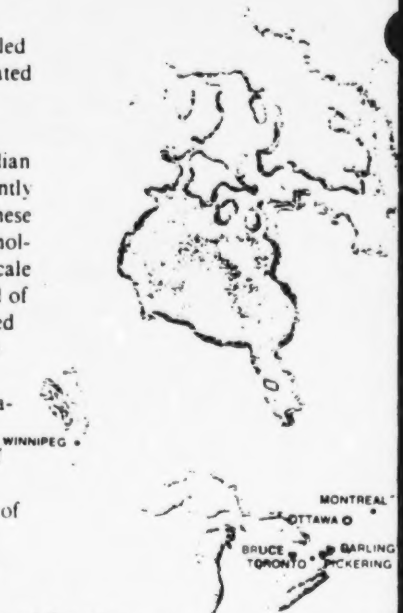
Canada's Nuclear Reactors

Canada generates about 15 percent of its electricity from nuclear power. The country's nuclear system at the end of 1988 consisted of 18 operating power reactors for an installed capacity of approximately 13 000 MW. By 1993 with the completion of the 4 additional reactors now under construction at Darlington, Canada's total nuclear system will be 16 700 MW and will produce 20 percent of the country's electricity. There are no restrictions to further expansion.

Canadian nuclear power stations are situated in the province of Ontario, which has 16 reactors, and the provinces of Quebec and New Brunswick, which have one reactor each. The provincial government utilities, namely Ontario Hydro, Hydro Quebec, and New Brunswick Power own and operate the reactors.

Nuclear energy in Canada is regulated by the Atomic Energy Control Board, an agency of the federal government. A federal Crown Corporation, Atomic Energy of Canada Limited (AECL) has the mandate to develop and promote the use of nuclear energy in Canada. It designed the highly successful CANDU (CANada Deuterium Uranium) reactors which are fueled with natural uranium and moderated and cooled with heavy water (deuterium oxide).

Three early stations in the Canadian nuclear power program are currently undergoing decommissioning. These projects will help refine the technology for decommissioning large-scale reactors when they reach the end of their useful life. Experience gained from the replacement of pressure tubes at two reactors at the Pickering Nuclear Generating Station has shown that major components in the core of a CANDU reactor can be removed and replaced. This holds the promise of greatly extending the lifetime of CANDU reactors, given suitable maintenance and refurbishing.



The map shows the location of Canada's nuclear power stations. In O the Pickering Nuclear Generating Station and the Bruce Nuclear Pow Development each has 8 operating reactors. The total electrical genera capacity of Bruce is 7 170 MW making it the largest nuclear power sta in the western world.

NUCLEAR WASTE MANAGEMEN

Responsibility

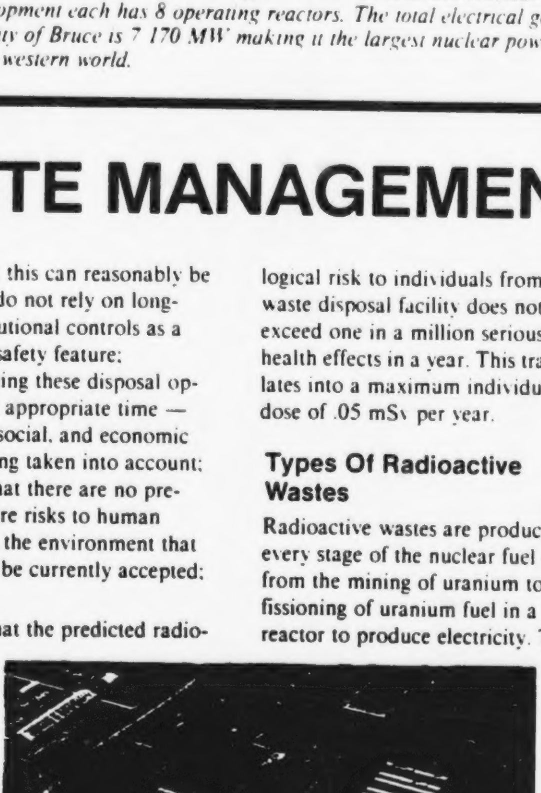
The primary responsibility for management of radioactive wastes in Canada rests with the producers of the wastes. The Government of Canada accepts responsibility for the management of wastes where the producer can no longer be held responsible (for example, if the company no longer exists), and the provincial governments are responsible for the long-term security of uranium mine and mill wastes. The federal government is funding the development of a technology for permanent disposal of nuclear fuel waste.

The Atomic Energy Control Board licenses sites where nuclear wastes are stored, and has published regulatory guidelines for disposal. The basic requirement of these guidelines is that the burden on future generations from nuclear waste will be minimized by

- selecting disposal options for radioactive wastes which, to the extent that this can reasonably be achieved, do not rely on long-term institutional controls as a necessary safety feature;
- implementing these disposal options at an appropriate time — technical, social, and economic factors being taken into account;
- ensuring that there are no predicted future risks to human health and the environment that would not be currently accepted; and
- ensuring that the predicted radiological risk to individuals from a waste disposal facility does not exceed one in a million serious health effects in a year. This translates into a maximum individual dose of .05 mSv per year.

Types Of Radioactive Wastes

Radioactive wastes are produced at every stage of the nuclear fuel cycle from the mining of uranium to the fissioning of uranium fuel in a reactor to produce electricity. Thes



Ontario Hydro's low-level and intermediate-level wastes are stored in special facilities at the Bruce Nuclear Power wastes have varying levels of radioactivity. Generally they are managed according to the concentration of radioactive materials and how long the radioactivity will last before it decays to a safe level.

Uranium mine and mill tailings consist of residue from crushed and ground ore and some of the chemicals used in the extraction of uranium. Potential hazards come from the introduction of chemical pollutants into the environment, the possible physical instability of the tailings piles, and the radioactive decay products of uranium and thorium.

Low- and intermediate-level wastes result from the day-to-day operation of reactors and include filters, maintenance mops, plastic sheeting, and protective clothing.

High-level wastes are the used fuel bundles taken from a reactor or the wastes generated if the used fuel were reprocessed. Although reprocessing is being done in some countries it is not an economically viable option for Canada at this time. It is cheaper to mine uranium for new fuel than to recycle used CANDU fuel.

However, if recycling is considered in the future, AECL has the technology to solidify the liquid wastes that would result from reprocessing and incorporate them in highly insoluble glass or ceramic in preparation for permanent disposal. Since all of these wastes are radioactive for thousands of years, they must be safely managed for a long time.

Amount of Wastes

There are now about 165 million tonnes of uranium tailings in Canada. This is about 2 percent of all mine wastes in the country. By the year 2000 an estimated 230 million tonnes of uranium tailings will exist.

The production of low- and intermediate-level radioactive wastes is about 10 000 cubic metres per year. About 250 000 cubic metres of low-level waste have been accumulated.

Up to the end of 1987 there were approximately 12 000 tonnes of used fuel in storage. By the year 2000 this figure is expected to increase to 27 000 tonnes of used fuel.

PLANS AND PRACTICES

Uranium Mine and Mill Tailings

In Canada uranium tailings are generally contained in natural basins enclosed by impermeable, engineered dams. Lime is added to the tailings slurry to aid in the precipitation of heavy metals (for example, thorium and lead). The separated water is treated with barium chloride, which assists in the removal of radium so that the effluent water meets all required environmental regulations. Variations of this basic process, such as the use of concrete vaults for tailings from very rich ore, are being studied and tested.

As with other mine tailings in Canada, the primary concern with uranium tailings may be chemical rather than radiological. Some ore tailings generate acidic discharges which are harmful to aquatic life, and therefore must be chemically stabilized. It is likely that uranium tailings will continue to require some degree of institutional control.

Low- and Intermediate-Level Wastes

All the nuclear power utilities in Canada have low- and intermediate-level waste storage capabilities. For the past 20 years Ontario Hydro has operated a central facility at its Bruce Nuclear Power Development site for the low- and intermediate-level wastes from its nuclear generating stations.

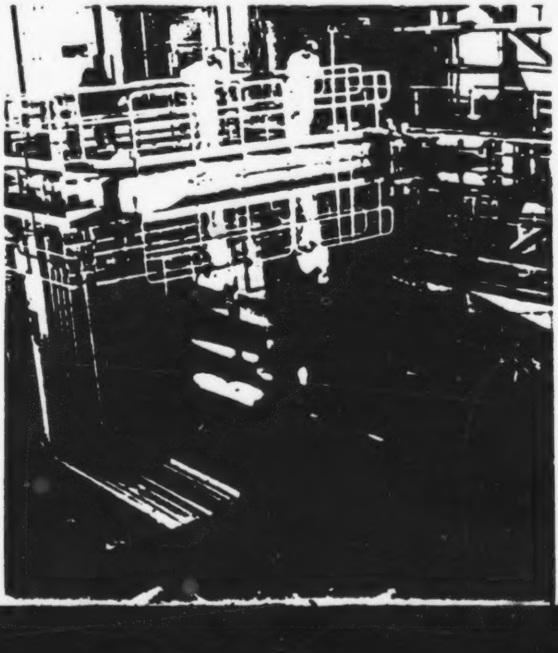
An incinerator and compactor are used to reduce the volume of the wastes, and to increase storage efficiency. Ontario Hydro uses 4 basic storage methods:

- shallow, in-ground reinforced concrete trenches;
- vertical, concrete tile holes backfilled with concrete;
- above-ground concrete "bunkers"; and
- low-level waste storage buildings.

AECL is constructing a prototype intrusion-resistant underground structure for the permanent disposal of low- and intermediate-level wastes. Construction of this facility is scheduled to begin at AECL's Chalk River Nuclear Laboratories in 1989. This will be the first permanent disposal facility in Canada for low- and intermediate-level radioactive wastes and when licensed it will replace the current practice of interim storage.

Nuclear Fuel Wastes

Used nuclear fuel has been stored in water-filled pools at Canadian nuclear generating stations for 25 years and it can continue to be stored there safely and economically



Used fuel bundles are stored in water-filled pools at the generating stations.

Dry storage in concrete canisters has been developed as an option.

for many decades. The safe management and storage of the used fuel is the responsibility of the utilities that own the reactors. Above-ground concrete canisters for dry storage of used fuel are also being used.

In 1978 the Governments of Canada and Ontario agreed to cooperate in the development of technologies for the safe, permanent disposal of Canada's nuclear fuel waste. They launched the Nuclear Fuel Waste Management Program. AECL was given the responsibility of assessing the concept for the disposal of nuclear fuel wastes deep in the stable granitic rock formations of the Canadian Shield and for developing and demonstrating the associated technologies. Ontario Hydro was asked to develop the technologies for the interim storage and transportation of used nuclear fuel.

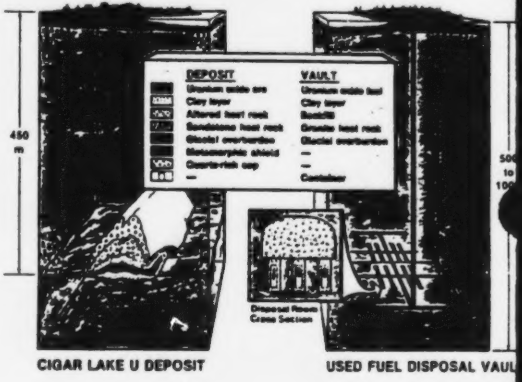
The concept for the permanent disposal of nuclear fuel waste (used fuel or immobilized reprocessing waste) is now well advanced and has entered a public and regulatory review phase. AECL will submit its Concept Assessment Documentation for both technical and public review in 1991. Disposal is likely to start about 2015.

The Canadian disposal concept proposes the burial of suitably packaged nuclear fuel waste in rock in the Canadian Shield. The disposal vault will consist of an engineered excavation 500 to 1000 metres deep. The fuel waste will be sealed in corrosion-resistant containers and emplaced in the floor of the rooms in the vault. A mixture of sand and clay will surround the containers. When the rooms are filled, the rooms, access tunnels, and shafts will be backfilled with a mixture of clay and crushed granite, and sealed. This system of multiple barriers is designed to meet the stringent regulatory requirements for the protection of people and the environment.

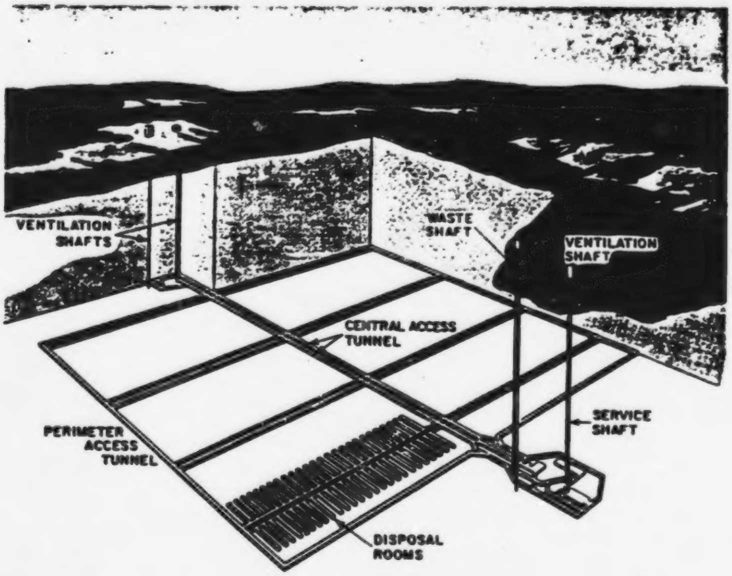
A major component in AECL's nuclear fuel waste management research and development program is the Underground Research Laboratory (URL) that is being constructed in a large body of rock known as the Lac du Bonnet batholith. This is the first such test facility to be built below the water table in previously undisturbed granitic rock.

The work at the URL and in an extensive borehole network surrounding it has assisted Canada in the development of a methodology for geologic characterization of actual disposal sites. Preliminary underground experiments began during 1986. The United States Department of Energy, Japan and Sweden have cooperated in the development of the URL.

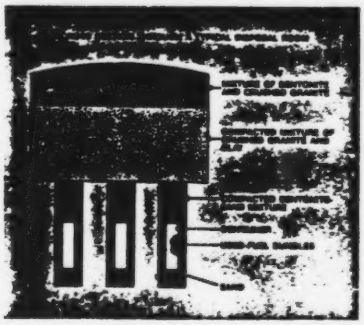
The URL is a dedicated geotechnical research facility constructed in granitic rock in the Canadian Shield near Winnipeg. It provides a representative geological environment in which to carry out geoscience research.



In a uranium deposit at Cigar Lake there is no evidence of uranium at the surface even though groundwater is present in the deposit. A study of this ore deposit to find out why it has remained concentrated in one place has provided useful information on how nuclear fuel wastes in a disposal vault can similarly be kept isolated from the environment.



The Canadian concept for permanent nuclear fuel waste disposal is to bury the suitably packaged waste 500 to 1000 metres deep in stable rock in the Canadian Shield. A network of underground tunnels and disposal rooms about 2 kilometres square will hold 190 000 tonnes of used fuel.



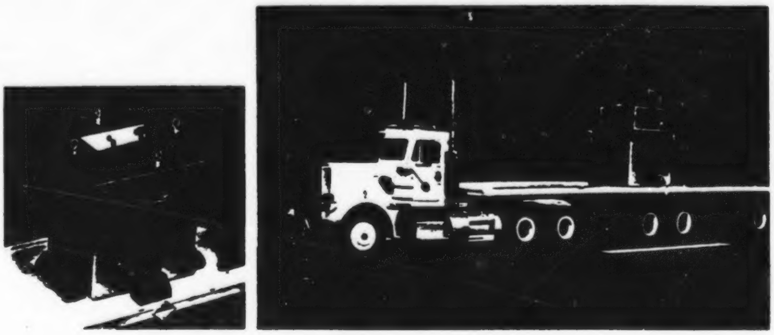
Holes will be drilled in the floor of the underground emplacement rooms to receive the waste. When the repository is filled, it will be backfilled and sealed.

Extensive experiments being conducted at the URL are helping scientists determine how rock and groundwater behave at depth and how they are affected by the heat given off by the used fuel. All heat experiments are simulated. Nuclear wastes will not be used in these experiments nor emplaced in the URL.

Transportation

Various means of transportation for the off-site shipment of used fuel to a disposal site, a reprocessing plant, or a central storage facility are being considered. Ontario Hydro has developed a transport cask for large-scale movement of used nuclear fuel. A quarter-scale model has been subjected to intense safety regulation tests including a 9 metre drop, a drop onto a steel pin, and thermal and pressure tests. When the design was approved by the Atomic Energy Control Board a rectangular, stainless steel cask was constructed. The cask with the lid is about 1.6 metres by 1.9 metres at the base and 1.8 metres high. With its load of 192 used fuel bundles, the cask weighs about 35 tonnes.

A special transport cask has been designed and built by Ontario Hydro. Before it was licensed, it underwent a series of tests to make sure it could withstand severe accident conditions.



INTERNATIONAL COOPERATION

The safe and responsible management of radioactive wastes is an important issue for all countries that have chosen to pursue the option of generating electricity with nuclear power reactors. The international cooperation in finding acceptable strategies for managing these wastes is well developed. Many countries have both formal and informal cooperation programs, agreements that assist in research and development of technologies for handling all types of radioactive waste.

Canada has cooperative agreements with the United States, Sweden, and the Commission of European Communities. Additionally, informal exchange agreements with other countries and Canadians serving on IAEA and OECD/NEA working groups help to keep Canada fully informed of international developments on radioactive waste management. AECL participates in the OECD/NEA International Stripa Project for underground experiments relevant to nuclear waste disposal.

The URL is constructed in a previously undisturbed portion of rock, which was well characterized before construction began. Most of the shaft and all potential testing areas are below the water table.

INFORMATION POLICY

AECL has made a commitment to full public access to information related to its nuclear fuel waste management program. All reports produced are available for public review. A Technical Advisory Committee (TAC) was established to provide ongoing independent technical review of the research program. The TAC is composed of a group of distinguished scientists and engineers nominated by Canadian professional societies. The Committee reviews all research activities and produces an annual report in which it offers its recommendations on the program. This report is widely distributed and available to the public.

One of the objectives of AECL's public interaction policies is to obtain input on important social issues from the public, thus assisting in developing acceptable strategies for managing nuclear wastes safely. AECL has been actively involved in a public consultation program to ensure that public concerns about the disposal concept are being addressed.

If you would like further information about the Canadian Nuclear Fuel Waste Management Program please contact the Waste Management Program Responsibility Centre at

Atomic Energy of Canada Limited
Pinawa, Manitoba, Canada
R0E 1L0
Telephone: (204) 753-2311

1988 NUCLEAR ELECTRICITY GENERATOR RANKINGS

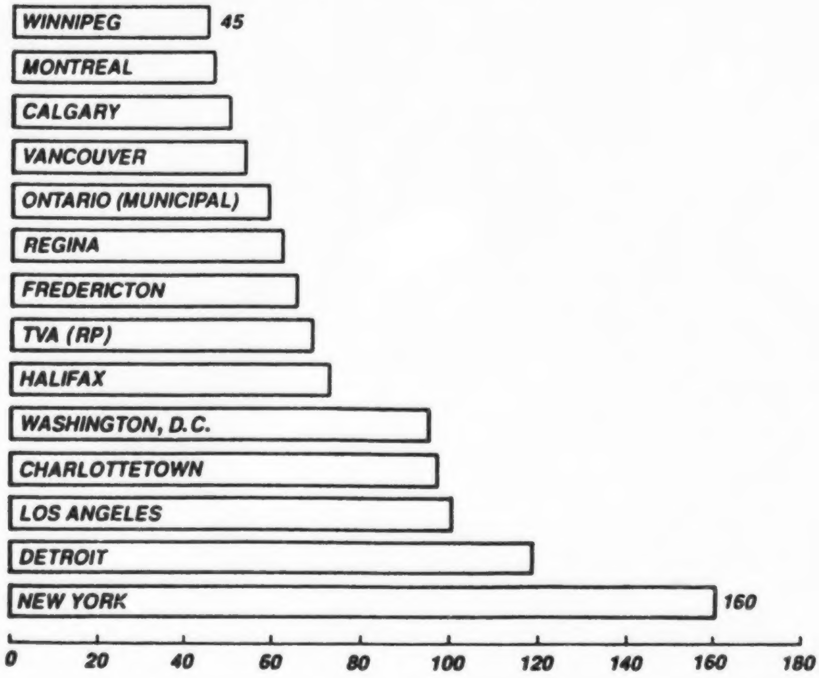
		GROSS GENERATED 10^9 KWh	INSTALLED NUCLEAR CAPACITY MW GROSS	NUMBER OF UNITS	1988 CAPACITY FACTOR %
1.	USA	554	101,347	109	63.52%
2.	France	275	54,755	55	58.49%
3.	Japan	174	28,046	36	70.68%
4.	West Germany	145	22,600	21	74.01%
5.	Canada	86	12,919	18	76.69%
5.	Ontario	74	11,554	16	74.67%
6.	Sweden	69	10,067	12	77.05%
7.	UK	63	14,942	40	55.90%
8.	Spain	50	7,951	10	77.56%
9.	Belgium	43	5,718	7	85.33%
10.	S. Korea	39	6,666	8	67.23%

Note: Centrally Planned Economies not included.
USSR was 3rd in nuclear electricity generation in 1987

Source: Nucleonics Week, Feb 2, 1989

FIGURE 1

1988 MONTHLY RESIDENTIAL ELECTRIC BILLS
1000 KILOWATT HOURS - CDN $



Source: Ontario Hydro

FIGURE 2

REQUIREMENTS FOR NUCLEAR OPTION

- Environment
- Safety
- Cost
- Economic benefits
- Security of supply

FIGURE 3

CANDU WORKER SAFETY

In 30 years to the end of 1987, CANDU workers accumulated 133 million hours in nuclear operations with the following results:

- There has never been a nuclear-related fatality
- No employee has ever incurred a detectable radiation-induced injury

Source: Ontario Hydro NGD-9 (1987)

FIGURE 4

CANDU PUBLIC SAFETY

In 172 reactor years of operation:

- There has never been an acute release of radioactivity
- There has never been a release of radioactivity which resulted in a measurable dose to a member of the public

Source: Ontario Hydro NGD-9 (1987)

FIGURE 5

CANDU CAPACITY FACTORS

		1988 %	LIFETIME %	LIFETIME WORLD RANKING (out of 322 reactors)
1.	**Pickering 7**	96.6	91.2	1
2.	**Point Lepreau**	95.7	88.8	2
3.	**Pickering 8**	82.5	85.3	9
4.	**Bruce 5**	90.9	85.1	11
5.	**Bruce 6**	83.8	84.0	16
6.	**Pickering 6**	100.1	83.0	17
7.	**Bruce 3**	44.5	82.5	18
8.	**Bruce 4**	62.9	82.0	21
9.	**Pickering 5**	97.9	81.9	24
10.	**Pickering 4**	70.3	81.0	30
11.	**Bruce 7**	66.0	78.7	43
12.	**Bruce 1**	62.7	78.5	45
13.	**Pickering 3**	83.9	77.6	51
14.	**Wolsong**	79.4	76.7	55
15.	**Bruce 8**	81.4	74.0	77
16.	**Bruce 2**	67.4	71.9	89
17.	**Gentilly 2**	93.8	66.4	144
18.	**Embalse**	86.8	65.0	155
19.	**Pickering 1**	88.4	62.8	176
20.	**Pickering 2**	14.5	57.9	217

Source: Nuclear Engineering International

FIGURE 6

CONFERENCE SUMMATION*

Presented by

Tom Kierans
President
ScotiaMcLeod Inc.
Toronto, Ontario

ONTARIO'S ENERGY CHOICES CONFERENCE
April 3-4, 1989, Toronto, Ontario

* This paper was transcribed directly, with very few editorial changes, from the tape of Mr. Kierans' remarks. It has not been reviewed by Mr. Kierans.

I want to begin by congratulating Ralph Brooks on the importance of the CANDU costing exercise that he's just been through. People such [illegible] Hare, Ralph Brooks, and others whom I regard with enormous [illegible] are helping us to work our way through some of the most difficult issues of our times. Next, I would like to acknowledge the contribution of Bob Wong, the Minister, and Premier David Petersen in terms of initiating this process. It's an important process. It's a process that holds the possibility, albeit not the probability, of achieving consensus within our society around some very difficult issues.

In that context, I would say that I also extend them my sympathies. I think that politicians get elected, or seek election which is different, because in many cases they think that they can bring consensus to society, that they can do something that the former person in power could not do, and that they can do it better. None of them, of course, seeks confrontation; few of them, such as for the sake of example Mrs. Thatcher, seek leadership and confrontation. I think that the issues that we've heard about over the past couple of days transcend the point of consensus. There is no question that it is the responsibility of an elected leader to extend within society an educational underpinning, so that citizens in a democratic, pluralistic, liberal environment can make a decision. I'm not at all sure as an individual that this applies or is entirely doable across the board in some of the issues that we're looking at. I refer to nuclear, on the one hand, and to the environmental mandate on the other. These are issues which are exquisitely complex, and that are also born out of strong, social values that are brought to bear by individuals. I don't think that at the end of the day, at the end of the process of education and consultation, politicians will be able to avoid the final mandate which is to exercise leadership. I think that some of the issues have gone on too long and require that we place our trust in the hands of experts and in the hands of politicians, the people whom we elect to interpret the advice of those experts. And I think that that's what we've come down to, and I don't think that we have much more time to waste. There are unavoidable tradeoffs in my judgement between the environmental mandate, on the one hand, and economic growth, on the other. There is also a split between those who accept the nuclear mandate, and those who may appear to accept it. When you get into these kinds of issues which are enormously important to individuals, they can turn on a dime. The politics of the nuclear issue, for the sake of example, which may show a soft 78% approval rating can turn right back into confrontation once someone makes a decision whether or not to proceed with it. And, in my judgement, that's what's going to happen.

A politician also has an enormous problem differentiating between the advice that he or she receives. I think of what Brian Kelly was showing us a few minutes ago, and it's very plausible and in fact it may be very doable. The fact of the matter is can it be done voluntarily, must it be mandated, can it be done with demonstration subsidies, or, in fact, is it doable at all? And if you are a politician and if you are rolling the dice, and we've heard about the 15-20 year lead times, where are you going to err -- on the supply side or on the assumption of the demand side.

There is also the problem from the politician's point of view of the public's notion of simplicity, that there is a quick fix. But we have heard enough in the last two days, and most of you are professionals who have heard enough in the last decade, to know that there is no quick fix. This is going to be a tough, long-term type of game. It's going to depend on a lot of factors about which I want to talk--research, science, demonstration, development, things which have long lead times--because it's also going to turn into a trade-off between the environmental mandate, on the one hand, and the desirability for economic growth, on the other. I hope that our politicians will use the right instruments, I hope that they will make the right decisions, and I wish them luck; but it's tough.

I have been challenged in private throughout the last two days to discuss the issue and the words sustainable development. In that connection, let me say first of all that I don't really appear before you as a summarizer, but rather as a rapporteur, which implies a subjective judgement hopefully based on some serious thinking. The sustainable development issue is the most important issue that impacts on the environment, energy and the economy for the foreseeable future. The problem is that the definition remains a little wide although it has come some way. I take you back to the middle seventies and the Thomas Berger report. All of us remember how beautiful that report and how evocative the language. Few of us, if any, remember that there was another report more or less contemporaneously produced by an FPC judge, by the name of Judge Nahoom Litt, who was ruling on the Arctic Gas, El Paso, Maple Leaf, Foothills, whatever you want to call it, applications. And he had a phrase in that report which I have forever after cherished. I quote, "Arctic Gas is right in asserting that El Paso's five percent contingency for cost overruns is elastic, stretching like skiplander to cover each and every general deficiency." Then, for the rest of us, he has a little footnote and he defines skiplander, "Skiplander is the boat of the Norse gods, small enough to fit in the pocket, but elastic enough to carry all of the gods who wanted to be transported". That is very elegant. It also comes down to the Brundtland report which has done so much, and we can go back to Barbara Ward and, if you wish the Club of Rome, to inspire us to deal with these issues, but in many senses the juxtaposition of those two words, sustainable development, is a compromise.

What we tried to do in the Energy Options process was to harden it, and we hardened it by saying the following, "by sustainable economic development, however, the committee does not mean simply reserving existing resources for future generations. Rather it indicates the obligation to manage all existing resources now to enhance our options, thereby favouring future generations with capital, an educated labor force, technology and a resource-base mix that will yield a potential for per capita economic prosperity that is at least as great as that which Canadians currently enjoy." It's an economic concept. It's an attempt to take an economist's paradigm as opposed to a physicist's paradigm, and to impose it on this particular issue. The bridging points between those two issues are science, research, development, demonstration, and technology. The bridging points are roles for governments, and the bridging points are an understanding of the meaningfulness of time. How much time do we have to work with, how much time are we allowed to work with, and how much is it necessary that we jettison the engine of economic prosperity, which is the market economy?

In that context, I would draw to your attention my personal challenges which I would put to the Ontario policy maker in the energy, economic and environmental aspect. First of all there is the question of leadership versus consensus. I think I've already indicated that I don't think it works. I think it is important that at the end of the day the politician or the leader be able to point to the fact that he or she has strived mightily to educate most of the people. But the fact of the matter is that the issues are subtle, number one; they are tied in with our notions of entitlement and simplicity, number two; and they're tied in with our overall view that we can achieve without risking. And at the end of the day, the politician is going to have to stand up and call this one. I'm particularly pleased today that Ralph Brooks' report follows on that of Ken Hare's report that the nuclear technology, as a crucial component of the energy mix and not as the dominant driving factor, is something that can continue to grow. The fact of the matter is that politicians are going to have to acknowledge that.

My second point would be to Ontario politicians, and I say this not in a partisan sense having been part myself between 1973 and 1984 of most of the energy mistakes of a previous party. They have to live and lift their sights above their shoelaces. The example that I like to use most often about Canadians and it's drawn from Northrup Fry is that we tend to hunker down on the 49th parallel with a 180 degree vision point, looking south but never ever looking behind us to the north, which is essentially the single factor which determines our character as a people. In Ontario that case is different, and it's harsher. I think we also tend to hunker down on the 49th parallel, and in fact fortunately for us south of that, but we look north with the same 180 vision. We don't see much further than Kenora in the west and Hawksbury in the east and James Bay in the North. We don't really have a vision of the nation. We just tend to think that we do. And we, of course, as most Canadians ignore the north, try to ignore to the best of our ability the United States fact. I'll give you some examples. We have had a preoccupation in Ontario with the domestic, within Ontario, security of supply. That goes back to 1906 when Ontario Hydro was set up. But the operative word is domestic. We're not a whole lot interested in Alberta gas, or B.C. coal, or Manitoba hydro-electric, for the sake of examples. There is an inordinate preoccupation with internal Ontario security of supply. I would hope that we could get off of that. Over many years we have lobbied to acquire extra provincial resources at something less than market prices. Sure we can point back to the Borden Commission when we actually paid a little bit more for oil than Montreal did, but the fact of the matter is whenever the rubber met the road, we wanted to buy western resources for less than their market price.

Thirdly, we fought to reserve the resource supplies of other provinces within Canada for what is essentially the Ontario maw, whereby the insurance premium was paid by somebody else, i.e. the resource producing provinces. And then, of course, we topped that off with what I call the "Polysar issue" when we decided that that wasn't enough and we also wanted to make sure that a petrochemical industry was built in Ontario and not in Alberta and we fought like hell to keep it here. I would hope that our current group of politicians would be able to reach beyond that and to look to a nation-building view of their energy and environmental requirements because therein in my judgement lies our greatest security.

My fourth point would be that I would hope we would also as Ontarians, rich, protected, vibrant, put more reliance on markets. Markets are not a panacea for policy, they don't replace the need for policy; but as instruments of policy they are the best generally that we ever get. I would hope that we could tend to look at Ontario Hydro as being not more responsible to government, and this is this government's policy, but rather more responsible to markets. This is an important differentiation which I would like to make. I'm well aware of the fact that there is a countervailing answer which is it's a monopoly, etc.. That's fine, but the Brits got there a long time before we did. Privatize it if you can, but if you can't privatize it, make it susceptible a much more market-based regulatory environment as opposed to an set-building regulatory environment. And they have done that, and they have done that very efficiently. In Energy Options we looked at the model of privatizing the crown electrics, not Ontario Hydro specifically. In the end what we concluded, of course, was that we had built a funny model, kind of a hybrid model in Canada, which is quite peculiar because it existed within the North American trading environment and within the North American pull and within North American, capitalistic views. But that model, the model of the provincial crown electrics, had actually worked. And when one compared that with the butchery that the Americans had made of the regulatory system, one was going to approach the breaking of this crown electric model very carefully. But one did not have to say that it couldn't have been calibrated more to be more market-responsive.

I would also suggest to our Ontario politicians and to our Ontario government that their preoccupation with security, which is an historic

Ontario predilection, both with the supply of the resources and with the pricing of the resources, particularly hydrocarbons, is misplaced. Natural gas is abundant and we are fortunate to live in a country in which we have access to those types of supplies. Yes, it's price-sensitive, but so what. Anybody else is going to suffer substantially before we do. We have a transportation advantage at least vis-a-vis New England, and the northeast states which are our principal manufacturing competitors. And then take a look at oil. We have had this long standing love affair with the fact that somehow we have to be rendered impermeable from the influences of the international oil cartels. I've never been able to understand it. Let's say we had complete physical self-sufficiency of oil within the province of Ontario and within Canada, and that we were able to achieve this by regulating prices below those of market prices. What good would that do us? We would be awash in a sea of oil while the Canadian dollar went from 83 1/2 cents to two dollars. We couldn't sell our manufactured products; therefore, the answer has to lie elsewhere.

When one looks at electricity, one should keep in mind that our comparative advantage in electricity, equally as it is in oil and in natural gas, is one of accessibility and reliability, not one of a cost subsidization. Let's not fool ourselves as to why Honda has built a plant, for the sake of example, in Alliston. They're not there because they think that Lake Simcoe is going to get caught in the greenhouse effect and there's going to be palm trees and they're going to make money on real estate. They're there for the very simple fact that if you have outages of more than a couple of seconds in your electricity supply, and I go back to the robot technology and a variety of other things, you don't go back and fix a bent fender. You trash fourteen cars, and you re-melt them and you start all over again. This is a comparative advantage that Canadians have that the United States does not have. Let's be awfully sure when we're looking at these issues how we feel about them.

In that connection I want to make another point, and I go back to the point about the difficult decisions that politicians have to make. Do you err on the side of supply or do you err on the side of demand management and the environment, and that, of course, is a conundrum and an impossible choice. But, I do want to attack a single notion which is somehow that we're moving into a service economy and we don't need this stuff called energy supply anymore. David Foot spoke about the demographics; Carl Beigie eluded to it; but the bottom line is that the statistics are contaminated. The fact of the matter is that industry is going to locate in Canada because of accessibility and reliability, and that is not going to change. The statistics that you have been seeing are a function of the downsizing of very large corporations throughout the very early eighties in which people were declared redundant and put on consulting contracts, and therefore went into StatsCan on the basis of being consultants in service industry. This is not the way of the future. We are in the manufacturing business, we're in the industrialization business, we're in the robotics business, and we need energy and we need it reliably. We don't need concessions to price, however.

Now let me take my head out of the clouds. I'd like to discuss a couple of things very quickly. First, flexibility and adaptability. The future is unknown. We don't know what the population growth is going to be; we don't know what electricity demand is going to be; we don't know what consumer reactions to the necessary internalization of environmental costs and, therefore, higher prices are going to be. Today's forecast basically is tomorrow's recycled printout, recycled I hope. Therefore, we have to do everything, and that starts on the demand side. Of course, we want to have demand side management. We want to be involved in energy efficiency, we want to be involved in conservation. And here I take minor exception with Colin Isaacs, good friend and a respected colleague on these issues who was a great help. He was lamenting yesterday that they should have gone to the word conservation as opposed to efficiency. I disagree with that because the word conservation raises the old hoarding notions and saving for the next generation. But, notwithstanding and leaving the terminology aside, we want to be there. We want to be in the business of the internalization of the public good, the commons if you would, in so far as its quantifiable and can be internalized within the processes over time. And we certainly want to be involved in education and volunteerism and we certainly want government support for demonstration projects. I think Ontario has done well in those areas, not as well as Colin clearly wants, but certainly from a conceptual point of view this is a government that is on top of these issues as well as anyone could be. Maybe a bit farther to go in terms of regulating or mandating them or educating them, but its on top of them.

On the supply side, that's where my problems come from because we have in a sense two monopolies and two mindsets. On the one hand, we have what I call the Ontario Hydro monopoly; on the other hand, we have what I call the Ontario monopsony. Let me deal with the second first. The Ontario monopsony is simply the power of central Canada through Ontario to exercise its electoral power in the crunch to impose its will on the resource-producing provinces. In terms of Ontario Hydro, I get nervous when we start talking about cogeneration, combined cycles, and a fear of gas prices going up. I'd like to see who makes that decision broadened just a little bit more. Perhaps if an [illegible]endent generator who could sell his power independently was [illegible]g the decision, he might make a different decision about the risk of prices going up or his customer might make a different decision, and I'd like to see the whole thing opened up a little bit.

And this gets back into my avoided-cost-pricing notion and the Ontario Energy Board, and a different kind of a role for the Ontario Energy Board within the context of a market-based regulatory system, keeping it away from being more responsive to governments and making it more responsive to the market. Two points out of that. The market is going to best deliver policy desiring a flexibility and an adaptability factor. That doesn't take away from the government the policy factors about where we should be going, but the market will deliver it best. As Henry Lee said yesterday, and I thought his was one of the really better presentations, who the hell knows, so cover all of your bases. Government policies can do that, but government administrators can't. And where necessary, regulators, market driven, can proxy markets.

My next point is regarding the environment. So far as the environment is concerned, the formula to me is that science minus uncertainty, reinforced by the common sense of the cumulative, irreversible damage effect, somehow equals standards. That is a big mouthful and a big jump. But standards may or may not be economic. And we want both growth, which means competitiveness, and the environment. The link, of course, is time and research, demonstration and development. There's a government role there. Therefore, there's no we/they role; there's none of this stuff about standing up and pointing the finger at industry, pointing the finger at the profligate consumer. We're all in this thing together, and the biggest problem is the problem of the dialogue of the fools, in which we impose standards time and again which are not scientifically-based and which are uneconomic. Any fool can wrap a scrubber around a tower, that's not a big deal. The question is internally, within our society, have we put in motion the technologies, or the research into the technologies, that will both cut the emissions and make it more economically efficient?

On the demand side, regarding research development and demonstration, the Ontario government is pretty good in theory if not in practice, and I'm not sure about that by the way. I'd like to see the Ontario government step out and do more regarding the supply and the processes. I'd like to see them do more on a couple of grounds. First of all, Ontario has been an enormous beneficiary of AECL, and this is the time for the Ontario government to stand up and be counted. AECL has been starved to death for a long period of time. This is an indigenous technology. Few people understand what it would cost to replace it if we were to import light water reactors, number one, and secondly, that it is an essential part, nuclear in the overall energy mix, not necessarily in Ontario, but without question in New Brunswick, in Newfoundland, and other parts of Canada. We've got to stand up and be counted at this particular point in time. We have large CANDU units and large CANDU quadrants, if you would, producing an enormous proportion of this Province's power by 1992. The fact of the matter is that the future of AECL is going be a function of the future on CANDU 3. And CANDU 3 is something upon which we have a cutting edge. It was said yesterday that the long lead times and the enormous capital commitments make all CANDU and light water technologies pretty much impractical. This doesn't apply to us. We have one that's on the drawing boards and we've got to get it off. Ontario has got to stand up. Its very silence is part of the problem; it has got to be part of the solution; and it has got to put some money in there. By doing both, if we can get that technology off the ground, and if we can get it exporting, than in fact we will be generating the revenues that will take the large CANDU units into another generation, and another generation, and another generation. What we can't do is to syphon our funds into AECL on a project-specific basis.

In the second sense, I would speak about coal. I know that we in Ontario are doing some things about low sulphur coal from the west, but I also know that a whole lot more has to be done. They have literally been starved to death. They don't have the money to put into cracker research, into fluidized bed research, or into research in terms of transportation problems. This is something that is in Ontario's interest because Ontario is going to have by 1992 somewhere between 70 and 72% of its base load energy mix tied up with nuclear. What we want are the options to broaden that out because we don't know what's going to happen in the future. We're not spending enough money on this. And there's an impoverished industry out there and it's an enormously abundant reservoir energy source for all of us. I agree, coal is not without its emission problems. Coal will never be purely environmentally benign, but what we're dealing with is a notion of relativeness and what might less be than, if that's English.

On the free-trade agreement, I am well aware of the fact that Ontario took a position. That's not the point. It has gone through and is now going to impact in the future on some factors which are very important to Ontario. And I speak specifically of natural gas in Article 904 of the Free Trade Agreement. Essentially what that says is that in the event of interruption under privately agreed contracts, we share the shortfalls. Ontario does not have a good record in terms on its national exposure, as opposed to its provincial exposure, on the natural gas issue. It's going to have to rebuild its credibility because it has an important role to play in what I regard as the dynamics of the Free Trade Agreement. In so far as where we are today, with an abundance of natural gas in the conventional producing areas, of an abundance of natural gas in the conventional transmission modes, we're in pretty good shape. There's not a lot to worry about. But what we're anticipating, and that's where Article 904 comes in, is the unknown at some point in the future. Don't hold me to my numbers or even my definition, but let's say that our percentage of deliverability or producibility goes from 25% to 35% to 45%. All of which might be good. But as we begin to tap into the Arctic, the possibilities of interruptability are going to be greater than they might otherwise be. At that point in time will be the debates and the recommendations by the National Energy Board, and in my reading the National Energy Board can't rule on this issue, that will in fact put the government on the spot where it will have to invoke 904. Now Ontario can play a major role in that because it's highly sensitized to that issue; but in my judgement it has to restore its credibility around reserve life ratios, around the desire to keep gas in the ground for its own uses, around the desire to get concessionary pricing issues, and I think this is an important issue for Ontario policy makers to look to.

Finally, I would make one other point. I sit on the National Round Table on the Environment and the Economy. I also chair the BCNI Task Force on the Environment. Industrialists are scrambling to meet the new environmental mandate. They may not be going fast enough, but they are really seized by the issue. Industrialists and CEOs are people like anybody else. They have grandchildren and they're worried about them. One of the major problems that I can't see my way through, in terms of trying to formulate recommendations to governments, is the nature of our federalistic country. We have a big problem. We have a problem whereby Ontario can afford to jump the economic standards environmentally of literally the rest of the country. And this is something we want to be very careful about. We don't want

Ontario playing jumpball against the federal government. What we want, if we want to keep the economic aspect of the thing moving ahead, is a cohesive approach in which we're moving together on a parallel line so that industry is not trying to respond to eleven different sets of rules. Ontario is the crucial point because, just as in terms of social policy issues where Ontario is rich enough to force its industries to internalize the cost of its social policies, so on environmentalist issues, Ontario may and I stress the word may, be rich enough to internalize the costs of its environmental policies. I think its important that we start moving in tandem.

I have a number of concluding remarks which are essentially pro forma. First of all again I want to repeat that I congratulate the Minister, Bob Wong, and the Ontario Ministry of Energy. Secondly I want to congratulate CERI for conceiving and organizing this timely and well thought out conference. I particularly want to draw your attention to some staff people. On behalf of the Ontario Ministry of Energy I want to acknowledge Anne Boody, Susan Main, Catherine McRae, Tania Timmins, Risa Drevnig, and Dick Dickinson. And so far as CERI is concerned, thanks to Nancy Sanford who was most helpful to me, Lola Medjedovich, and Carol Williams.

I want to thank you the audience for your participation. This has been very much a two way dialogue. Your questions enhanced the quality of the discussion and the understanding among everybody. And I think that's important. Finally, I want to say that each and every one of you is, to a greater or lesser degree, a pro in this emerging game. Canada for the first time ever is going to host the World Energy Conference in Montreal this September 17 to 22. You should go, and show them how far ahead we are. We at the technical staff level were enormously influential on the Brundtland Commission. Let's keep that part running.

In conclusion, reassuming my role away from Rapporteur to Chairman, I declare the conference adjourned. Thank you very much.